JOURNAL OF GAS LIGHTING & WATER SUPPLY.

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EDITORIAL NOTES.

Crusade by Coal Merchants against Gas Heating.

NOT long since, it was stated in a paper devoted to the coal industry that one of the reasons the colliery owners are again raising the price of coal to the gas industry—unduly taxing the gas industry, with, incidentally, additional gain to themselves, would have been a better description—was that, by their action, gas undertakings injured the retail household coal trade. This point was discussed by us at the time. Prior to that, we had found, from a circular emanating from a well-known firm of coal dealers, an attack on the gas-fire, the chief feature of which attack was the violation of truth. The coal merchants are evidently taking the matter of the competition of gas-fires, cookers, and water-heaters very seriously; and we do not blame them, providing they do not descend to, and so degrade themselves by, gross misrepresentation. While they confine themselves to legitimate statement, the gas industry cannot object, inasmuch as the latter, in its campaign, is not backward in pointing to the air pollution caused by the coal fire not only by smoke, but by the foul gaseous products of coal combustion in the domestic grate, to the labour and dirt involved by the use of coal in the household, to the trouble occasioned in replenishing coal fires, to the variability of the radiant heat efficiency of coal-fires (as well as the variability of room temperatures) between the time of putting on raw fuel and that at which it attains complete incandescence, on top of all which is the waste occasioned by the destruction, under the crude coal-burning method of house heating, of very valuable constituents of the coal. We do not think the coal merchants will say that any of these points in any way transgresses truth.

In a circular, however, which several coal-retailing firms have lately forwarded to householders, in conjunction with an invitation to, as early as possible, fill their coal cellars from the various firms' depôts, there are certain scandalous statements—highly scandalous applied to the gas-fire of modern design; and gas-supplying authorities had better take steps to counteract the statements which the circular contains, for they amount to nothing short of trade slander. On the front of the circular (it may interest gas undertakings to know) appear the words: "With the Compliments of the "Society of Coal Merchants, the Coal Exchange, E.C.;" but those responsible for the distribution of the circular are individual firms of coal merchants. In the first place, it is stated that the cost of a good house-coal fire for a week is about 2s.; while a "similar" gas-fire costs 6s. 6d. It is an immense modern gas-fire, with high-priced gas, that would cost anything like that in the time that a fire is required in any room during a week. No particulars, relative or otherwise, are given; so that it is impossible to discuss here the point of cost. As we pass down the circular, the allegations against the gas-fire get worse. Ventilation is next dealt with; and the coal-fire is described as a "fine *natural* ventilator." On the other hand, it is declared that "with a gas-stove, "each burner necessitates the addition of an extra 405 cubic "feet of air per hour to a room to ensure proper ventilation, "and cannot itself provide such addition, and that is why, "unless you keep your windows open, the air of a room "soon becomes unhealthy." Apart from misstatement, this is a very badly constructed passage, and ambiguous to the extreme. A coal-fire requires more air for combustion and ventilation than a gas-fire; but we did not know that a coal-fire could "provide itself" with the additional air that it requires, while a gas-fire could not do so. It is really a phenomenal, and indeed humorous, state of things that is presented by the coal merchants. If a coal-fire takes up the chimney more air and more products of combustion than a gas-fire, naturally it draws more air out of the room, which elsewhere the coal merchants profess is a very good thing indeed.

About that strange 405 cubic feet extra of air required per hour by a gas-fire, a modern duplex-burner gas-fire consuming 30 cubic feet of gas the first hour would for complete combustion need about 160 cubic feet of air, and, when the duplex tap is brought into play after the first hour, to reduce the gas consumption one-half, 80 cubic feet of air would meet requirements. The coal merchants are careful not to say what quantity of air is necessary to ensure the complete combustion of coal. They also make some stupid comparisons regarding the change of air in rooms. The necessary change is governed not by the requirements of either a coal or a gas fire, but by the purity of the atmosphere; and the change effected by a gas-fire may be quite sufficient, while that effected by a coal-fire may be more than sufficient, and therefore wasteful. Besides, neither a coal nor a gas fire is always in use in a room, so that the ventilating work is not continuous. Then the merchants quote a statement by Dr. W. A. Corfield at a Sanitary Congress. The disseminators of this indictment of the gas-fire do not mention the year of the Sanitary Congress in question, nor do they say whether the assertion refers to a modern or old type of gas-fire. It is also stated that many medical men will not treat bronchial cases if the patient employs a gas-stove. We should much like to know the names of the medical men, because in one London Gas Company's district not far short of 4000 medical practitioners now use gas-fires. No end of medical testimony can be quoted as to the value of the modern gas-fire, which would make the coal merchants look very silly, and feel extremely sorry for the beggarly nature of the case they have put forward.

The next statement is really more fit for a comic paper than for a circular emanating from a set of business men, who, we say deliberately, testify to the fact, by taking responsibility for the circular, that they do not know much about the matters treated upon. The reader of the quaint document is told that the average heat produced by a gas-fire does not come within 100° Fahr. of that from a coal-fire. Why not? It depends upon both the size and the conditions of the respective fires. Furthermore, it is said that of the heat produced 25 per cent. more is available as radiant heat (the heat which counts) with coal than is the case with gas. Seeing that the radiant heat efficiency of the gas-fire of to-day's make is from 50 to 55 per cent., and that the maximum radiant efficiency is constant, and not intermittent as in the case of the coal-fed fire, the argument of the coal merchants is rather defective. Another singular attribute is conferred, by these scientific coal merchants, upon the heat from the coal-fire. The circular says that the "heat from a coal-fire moves round obstacles easier than is "the case with gas heat. Gas heat largely remains local—"viz., in the immediate vicinity of the stove." Why the heat from a coal-fire should have more agility than that from a gas-fire is left for explanation to the imagination; but when a person believes such nonsense as this, it is time that he was taken care of by a benevolent country. The next point is that "gas exhales many noxious fumes, and of "these the worst, carbon monoxide, is without smell, and "1 per cent. may prove fatal." The products of combustion of gas-fires are sent up the chimneys and not into the rooms, unless, of course, the fires are fixed by someone who does not know his business. The products of combustion of a coal fire are also intended to travel to the open air by way of the chimney; but they are far more noxious than those from the gas-fire. As the result of the experiments on gas-fires made by the Leeds University, it was reported that "no "carbon monoxide escapes under ordinary conditions into "the room, and very little is ever found in the flue." In the Glasgow experiments, it was found that in the products of incomplete combustion in the flue gases of coal-fires, the proportion of carbon monoxide was 24·17 parts in 100,000

parts of flue gas; while in the case of the flue gases of gas-fires only 3·2 parts in 100,000 parts were at any time discovered. What have the coal merchants to say to this?

There are other absurd points in the circular; but we have dealt with the principal ones. In concluding the comment, we would, in perfect friendliness, urge the coal merchants not to go too far in this traducing campaign on unproved information in connection with modern gas heating. Ancient opinion and ancient statements do not conform with contemporary conditions and facts; and had the coal merchants only displayed the business acumen with which we have hitherto credited them, they would have made sure of their ground before distributing a circular (copies of which have been sent to us from various districts) that constitutes a piece of as unworthy as it is gross misrepresentation. The circular has been sent out broadcast by various coal-trading firms; and therefore the managements of gas undertakings should ascertain whether copies have been distributed among the residents in their areas, and if so send out (at least) a rebutting circular, pointing emphatically to the misrepresentation, and placing householders in possession of the truth. There is ample material available of an independent character for every gas undertaking whose business it is to meet this circular campaign of the Society of Coal Merchants against domestic gas-heating.

Vertical Retort Life.

A SHORT article, and a remarkably convincing photograph, bearing upon the important question of the durability of intermittently charged vertical retorts, reach us from Mr. Edward Körting, the Chief Engineer of the Berlin works of the Imperial Continental Gas Association. Those critics of vertical retort working who have, by precipitating them against stubborn facts, exhausted their arguments over the questions of gas production, quality of gas and residual products, and lessened labour and troubles, have had to fall back upon the single question of the durability of vertical settings—this being a matter upon which they have felt they were shielded by time and variable conditions. But even time is day by day going against them. It seems almost incredible, so rapid is the flight of time, that there are standing at the Mariendorf works to-day vertical retorts on the Dessau system that have seen 2000 days' active service. But so it is; and it is the condition of the retorts after such a lengthy working period that forms the subject of Mr. Körting's communication and photograph. If we compute a working year of 200 days for the retorts, the 2000 days would represent ten years' service. In considering the excellent state, relative to service, of the retorts after this period, it must be remembered that the designers of the settings of those days were then only opening up new roads of experience under the circumstances of daily operation. They had then nothing much to guide them; and having done so well in realizing, with experimental conditions only to direct them, a good longevity in these working settings, it may be taken for granted that, with the accrued experience to help them to-day, still better results in respect of life may be confidently anticipated.

Quite early in the use of the settings, it was appreciated that merely slight deformations in the retorts would cause trouble in connection with coke discharging. It was also, Mr. Körting confesses, a matter of some anxiety as to whether the retort material would stand the high temperature at which the settings were to be worked; and there was close and constant investigation to produce conditions that would ensure that there should be no local overheating, and to obtain full control of temperatures at all vital points. But anxiety has vanished; and confidence that the designers are the masters of the settings, and not the settings defiant of the designers, is now perfectly established. The only anxiety concerning the "veteran" settings in question was as to whether the condition of the retorts was such that they could be trusted for another winter's run. To arrive at a decision, Mr. Körting had one of the settings opened out; and two of the retorts were cut through vertically. We have the result in the novel photograph. The retorts have been found in excellent condition, and can be kept in use—at any rate, for another year. The observations of Mr. Körting on what was found by personal inspection, and what is confirmed by an examination of the photograph, are interesting. The retorts have not changed in external form; the slight deformations in the interior are of no importance; the walls have retained their full thickness; and the material in the lower half of the retorts has become hard from sintering. We heartily congratulate the Mariendorf engineers on having, after their several years of strenuous work, achieved such excellent results. There is only one inquiry that suggests itself. It is as to whether, after scurfing, the area or carbonizing capacity of the retorts is the same, or practically the same, as it was originally.

This experience may be taken to answer the point that is sometimes raised in making comparisons as between intermittent and continuous retorts. Theoretically it would appear that the dumping of cold coal in a vertical retort should set up strains, by the alternations of contraction and expansion, detrimental to the life of the retorts. But as stated in a reference to the subject on April 8 last, we do not believe, on *a priori* considerations, that the contraction and expansion of intermittent retorts, through the dumping in of cold coal, is anything like so great as is sometimes imagined or represented. The life of these vertical settings at Mariendorf, designed and erected before there was much working experience to direct, is confirmatory of this view.

Temperatures in Vertical Retorts.

THE interesting table of tests of temperatures at the centre of the Woodall-Duckham vertical retorts at the Burnley Gas-Works—compiled from pyrometrical investigations by Mr. Raymond Ross, F.I.C., in conjunction with the Engineer and Manager (Mr. John P. Leather), and published in the "JOURNAL" last week (p. 720)—invite a little consideration. The experiments were, it is patent, conducted with every care, in the hope of obtaining accurate results; but some of the figures are a little inexplicable. In the Woodall-Duckham system, the greatest temperature is applied at the top of the retorts, and it gradually descends—the idea being to cause the gases in the fresh coal to be evolved as quickly as possible. The Burnley experiments were carried out with a 25-feet pyrometer (which, it is believed, is the longest ever used for such a trial), but considerable difficulty was encountered in making the determinations. The test-depths are measured from the rodding-holes. The figures show that from a depth of 2 ft. 6 in. to one of 11 ft. 6 in., there is a gradual ascent of temperature—it being at the latter point 875° C. Then at 2 feet greater depth, there is a drop to 735° C.; and at about 3 feet more, we get down to 600° C. At 17 ft. 4 in., the greatest temperature of all is found—905° C. One of the claims attached to the Woodall-Duckham setting is that, as the charge descends, it becomes heated; that the gases and other products are evolved at their various critical temperatures; and that the gases and other products, in flowing to the top of the retort, never have to pass through a hotter mass of material than that from which they were given off. There having been great difficulties experienced in carrying out the temperature tests, we should not like to assert that the figures are positively without error. But, assuming that they are correct, then the gases and other products produced at the 600° point, and flowing through the centre of the retort, would pass through higher temperatures until they reached the last 6 feet or so of the top portion of the retort. A little explanation to adjust the relationship of the claim to these test temperatures carried out under considerable difficulty, would be interesting, and possibly instructive.

The Economy of Gas Manufacture.

IT is an old-standing complaint that, though the gas industry takes such large part in the public service, and its operations are manifold and instructive, the Public Press practically ignores the claims to its processes, applications, and effects receiving a share of notice among the other large industries of the day. The "Engineering Supplement" of "The Times" has now opened its columns to gas-engineering topics, with a leaning somewhat to the popular side in the mode of presentment. It is due to our morning contemporary to say that it is not altogether blameworthy for the fact that this act of justice to the gas industry is somewhat belated, as it is long since that certain individuals were approached with a view to arranging for this expansion of survey, but the already placed activities of those approached prohibited the undertaking of further literary work of the kind. However, we are glad to see that at last a gas-engineering contributor has been found; and we hope, for the sake of the gas industry, that his connection with the paper will be of long duration.

Apart from the gas engineering notes in last Wednesday's

supplement, there is a special article upon the subject of "The Future of British Fuel." Among ourselves we have always boasted—and the truth is greater to-day than ever—that the gas industry puts coal to the most economical use, and shows the least waste from the processes to which it submits the raw material. On the heat basis alone this can be readily proved; but little (if any) information on the subject has reached the public eye. It does so now to those who read the supplement of our morning contemporary; but they are of a small minority in the country. Take in order the illustrations supplied in the article now before us—the domestic grate, steam raising, and gas manufacture. The coal merchants who are engaged in a campaign against gas heating will not thank the "Engineering Supplement" for having, on the morrow of the day when some of them posted in various districts the circular giving a fictitious character to gas fires (as noticed in another editorial), informed its readers that, with improved type ordinary open fires, the proportion of heat of the coal employed that is actually used in domestic warming does not exceed from 15 to 35 per cent., or, to give large measure, only one-third of the calorific power of the coal is usefully applied to the purpose for which the coal is bought. The rest emerges, *viâ* the chimney, into the open air. If a coal for heating purposes costs retail 21s. per ton, this means that, for the object for which the coal was purchased, 14s. are wasted. Then in steam-raising, it is seen that again about two-thirds of the calorific value of the coal are wasted; and therefore, of a ton of steam coal costing 20s., only 6s. 8d. produces value in the shape of steam. When we arrive at the carbonization of coal for gas making, it is quickly ascertained that here we have the most economical use to which coal is put; for the bulk of the original thermal value of the coal can be easily accounted for.

The writer of the article almost makes his gas-engineering readers blush over the good carbonizing character he confers upon them. From a ton of coal he says there are produced 11,785 cubic feet of gas, of an illuminating power of 20·15 candles, and of a calorific value of 781 B.Th.U. per cubic foot. In addition, the 12 cwt. of coke yielded has a calorific value of 12,653 B.Th.U. per lb. The coal from which this gas is made is reputed to possess a heating value of 32,220,160 B.Th.U. per ton. In his heat-balance the writer of the article—kindly disposed as he is to the gas-making process in view of the value it achieves in the form of separated products—does an injustice to it. He demonstrates that the gas from a ton of coal represents 9,204,085 B.Th.U., and the coke 17,005,632 B.Th.U.; but the remaining 6 million odd B.Th.U. he enters as loss. He totally ignores the heat value of the tar and pitch. The total heat units in the tar per ton of coal (according to quality) may be taken as representing from 7 to 11 per cent. of the total heat units of the coal, and the pitch from 1·3 to 2 per cent. If we ascribe to coke a proportion of the heat units of the coal equalling 61 to 70 per cent. according to quality, to gas 18 to 23 per cent., and to tar and pitch the percentages already named, then the loss of B.Th.U. will be reduced to from 2·5 to 6 per cent., which makes the case stronger than that put by the article in the "Engineering Supplement" in showing the superlative economy of coal carbonization from town-gas manufacture.

High-Pressure Gas Distribution.

Some highly interesting particulars have been collected by "Gas Age" as to certain high-pressure distribution and transmission systems in the States; and some sample statements are reproduced in our news columns. In this country, we are accumulating experiences with what we are pleased to call high pressures; but America can give us a long lead in regard to pressures at which gas is carried. In the notes, pressures of 30, 40, and even up to 80 lbs. are mentioned as something quite customary; while in this country, we are, generally speaking, content to allude to pressures as being high when only as many inches water gauge are referred to. The very first case in the notes is an especially interesting one. An initial pressure of 80 lbs. is reduced to 10 lbs. on delivery to the street mains; and then house governors are employed, which are regulated to deliver gas to the ordinary consumers' premises at 3 inches pressure. There we have an ideal condition of things for securing to each consumer a supply of gas at a regular pressure. The same thing applies to the town referred to in the last note. House regulators are used in most cases there; but, wherever possible, the practice is to instal one or two governors on a line of low-pressure pipes supplying several consumers. This is the favoured plan in that town, though it cannot always be followed on account of the distance between the consumers' houses. The general report is that little trouble is experienced on these high-pressure systems. There is no particular difficulty in regard to leakage. On the contrary, the accounts are uniformly good, and yet the joints are of quite ordinary character. In the first case to which reference is made, no special method is used for securing tight joints; in another, red lead and shellac are employed; in one or two cases, ordinary screwed couplings are favoured. In most instances expansion joints and Dresser couplings are inserted here and there on the system. These experiences from America are instructive; but we have to go some little distance yet to equal them in this country. But what is being done in the States will be an encouragement to go further in this country.

Efficiencies of Gas-Fires.

We welcome a letter from Mr. James W. Wilson, of Messrs. Wilsons and Mathiesons, Limited, on the subject of the "Hygienic and Heating Efficiencies of Gas-Fires," seeing that the controversy that has been proceeding in our columns is traceable to the proposal put forward by the Davis Gas Stove Company that the highest possible standard of hygienic efficiency should be adopted for gas-fires. From the first, we have been careful not to say that firms other than the Davis Company were not making fires that would comply with the suggested standard—that is to say, that the products of combustion should pass away by the flue-vent, and no part under the canopy, without the assistance of a flue attachment. We are pleased to receive from Mr. Wilson, for publication, the expression of his support—and valuable support it is from one occupying the position that he has done for so many years in the gas-stove industry—to the attitude that has been taken up in this regard; and, furthermore, there is equal pleasure in learning that the firm's 1911 series of fires satisfactorily pass the "Shadowgraph" test.

The Hygienically Perfect Fire.

But our correspondent goes farther than making this claim. He points out that many fires are fixed without the attachment of a length of flue-pipe; and therefore commonsense dictates that fires to be hygienically perfect when so fixed should be capable of discharging the whole of their products into the chimney. For the good name of gas-fires, there is a responsibility attaching to both makers and gas-suppliers in this matter. It is all very well to say that fires will pass all the products with a length of flue-pipe attached (that has never been denied, provided the flue-pipe is of adequate length); but makers have no control over fires after they leave their works, and there is no assurance that the necessary length of flue-pipe—the length necessary under local conditions—will be attached. In well-regulated gas undertakings, there is no question that the requirements of every fire in this respect would be carefully attended to; but all gas undertakings are not well-regulated in the department of their work—the fitting—where the utmost efficiency is of the highest importance. We do not want to labour this point, though it could be largely extended. Mr. Wilson also expresses an opinion endorsing the view that the complete removal of the products of combustion can be effected without materially decreasing the radiant efficiency of a fire. The independent tests that are being made, at the instance of the Davis Company, by Mr. W. J. A. Butterfield (the results of which we hope to publish shortly after the issue of the Institution number of the "Journal") we believe will confirm the opinion expressed by our correspondent and other makers, as well as the view of several gas engineers who have spoken to us on the subject.

Four Junior Associations' Fourth Meeting.

The fourth bi-annual joint meeting of the four English Junior Gas Associations has come and gone; and it is a pleasure to be able to record the fact that it was in every way as successful as its predecessors. In connection with functions of this character, the members of the Junior Associations, scattered as they are all over the country, suffer obvious disadvantages. But they do their best; and the gathering together of a party of about 120 last

Saturday at Sheffield proved it. The account of the proceedings which appears in another part of this issue shows what a good time the visitors had—thanks to the kind thoughtfulness of the Sheffield United Gaslight Company and their Engineer (Mr. J. W. Morrison), and to the Yorkshire Junior Gas Association and the Arrangements Committee who had the matter in hand. A varied choice of visits had been fixed up for the morning, while later in the day the members were let into some of the secrets of how gas is made and sold at from 10d. to 1s. 3d. per 1000 cubic feet, with perfectly satisfactory results from the point of view of the stockholders in the Company. What with the Neepsend and Grimesthorpe Gas-Works, and the coke-oven recovery plant at the Nunnery Colliery, there was plenty of instruction of a kind specially suited for those making their way in the gas profession; and the generous hospitality of the Gas Company added much to the pleasure of the social portion of the day's programme.

Extracting Benzol from Town Gas.

If there is no flaw in a statement made in the "Gas Engineering" notes in last Wednesday's Engineering Supplement of "The Times," the death-knell of debenzoling town gas has already been sounded. It is stated that a series of tests have been recently conducted in London so as to ascertain the effect of stripping 14-candle (or thereabouts) coal gas of its benzol. Creosote was used as the washing medium; and the investigators appear to have been somewhat disconcerted by the "remarkable" result obtained. The gas was by the washing so robbed of its light-giving hydrocarbons that there was no trace of luminosity remaining when tested on the ordinary table photometer using the No. 2 burner. The naked flame, however, it is stated, was not deprived altogether of its illuminating properties; but it was sufficiently to render the gas unfit for luminous purposes. The drastic effects of the creosote are a little out of joint with prior belief, and evidently with that of the experimenters; otherwise the result would not have been to them "remarkable and somewhat disconcerting." There is no mention of the effect upon the calorific power of the gas—a matter to which attention was directed in our columns on May 27 (p. 578). We should like to know something more about the composition of the gas both before and after the scrubbing, and a few more definite particulars from the source of the test. The present report suffers from its inadequacy of detail.

Petrol Price and Benzol Quality.

Some short time ago it was rumoured that, by the end of May the price of petrol would be up to 2s. per gallon; but something has intervened and caused the rulers in this matter to have it spread abroad that no such rise in price is now likely to take place—at least for the present. What has happened in the meantime? Is it the talk of benzol production, and the encouragement that the motor car industry and users are, in the hour of their tribulation, giving to schemes that purpose adding to the output? The "Motor" publishes week by week a list of some 200 companies and firms who supply benzol; and it looks somewhat formidable. But it does not mean much in the volume of produce compared with the demand for motor spirit. While, too, trial after trial proves the efficiency of a high-grade benzol in respect of car mileage per gallon and in other ways, there are heard statements that all benzol is not high-grade in respect of purity. Some makers' produce contains much more sulphur than that of others; and there is now talk of a standard being put forward in regard to the quality required for motor car use.

Municipal Gas-Works Finances.

Accounts are still coming to hand of the financial results achieved by gas undertakings in the hands of local authorities, on the working for the twelve months to March last. Details vary in different cases; but, generally speaking, the stamp of prosperity is upon them. Among the allocations of profits reported, it is noted that at Belfast the net profit realized is upwards of £66,000, in spite of additional discounts being allowed to consumers. A sum of £30,000 goes to the reserve fund; and the rates benefit, directly and indirectly, to the extent of some £21,000. The renewals fund at Birkenhead receives £10,000; and the rates, £15,000. Out of a credit balance of unappropriated profits at Bradford amounting to £29,000, the sum of £5000 goes to relieve the rates. The net balances at Bury are divided equally between the rates and the gas consumers; and on the present occasion there is £9000 to be thus disposed of. At Clitheroe, the price of gas is reduced, and £500 out of the profits is allocated in relief of the rates. In spite of a reduction in the price of gas at Coventry, there is a sum of £5000 available for the rates, £10,000 to meet the loss on abandoning plant at the old works, and £5000 for the reserve fund. Hinckley transfers £650 from profits to the relief of the rates; while at Leeds, out of a record surplus of £36,000, a substantial portion will doubtless be similarly disposed of. At Leicester, £34,000 is contributed in aid of the district rate, £5400 is placed to the reserve fund, and £6700 goes towards new meters. The rates benefit to the extent of £5500 at Lincoln, and the reserve fund is brought up to £9000; while at Mossley £700 has been transferred to the borough fund. Out of the net profit at West Bromwich, the Gas Committee have decided to appropriate £500 in aid of the general district rate.

PERSONAL.

Mr. E. B. Barnard has been unanimously re-elected Chairman of the Metropolitan Water Board. He was first chosen to fill this position in succession to Sir Melvill Beachcroft in 1908, and was re-elected in 1910. Mr. G. S. Elliott, the Mayor of Islington, has been retained in the Vice-Chairmanship by 29 votes, against 14 accorded to Mr. W. Whitaker Thompson, a member of the London County Council.

Mr. H. O. Stafford Cooke, of the Portsmouth Water Company, has been called to the Bar at Gray's Inn. Mr. Cooke was the winner of the Gray's Inn "Lee" prize, offered for the best essay on a selected topic; the subject chosen for 1913 being, "A Comparison between the Laws of England and those of our Dominions, relating to Combinations of Employers and Workmen, Labour Disputes, and Ensuing Labour Troubles."

OBITUARY.

Mr. William Fox, M.Inst.C.E., F.G.S., died at Norwood on Saturday. Born at Plymouth in 1847, Mr. Fox began practice in Westminster in 1890, and had acted as Consulting Engineer to many public bodies in this country in connection with water and sewage schemes, and had designed water supply and sewage works for Vera Cruz, Tampico, and other foreign towns.

The "Journal für Gasbeleuchtung" reports that the death occurred on the 5th ult. of Dr. Gustav Hilgenstock, who after several years' experience in blast-furnace and iron works, in 1893 succeeded his friend Dr. C. Otto as head of the firm of Dr. C. Otto and Co., of Dahlhausen. His name is best known in connection with the Otto-Hilgenstock type of coke-ovens; but he was instrumental in founding the German Associations for controlling sales of ammonia, tar, and benzol. He retired from work in 1911, and had attained the age of 69 this year.

The Carlisle Appointment.

It was mentioned in the "Journal" last week that out of the 41 applicants for the position of Gas Engineer and Manager to the Carlisle Corporation, in succession to Mr. Harold E. Bloor, the Gas Committee had recommended Mr. E. George Hutchinson, the Engineer and Manager of the Workington Corporation Gas Department. The recommendation was confirmed at the meeting of the Council on Tuesday. The successful candidate is thirty-three years of age, and was trained for the profession by his father, who is the Engineer and Manager of the Barnsley Gas Company, with whom he was engaged for seven years. He was for some time in the drawing offices and works of Drakes Limited, at Halifax, and of Messrs. Newton, Chambers, and Co., Limited, at Chapeltown, Sheffield; and he subsequently received special training in the manufacture of carburetted water gas and sulphate of ammonia under Mr. Fletcher W. Stevenson at Coventry. In 1905, he was appointed Chief Assistant Engineer and Manager of the Stockport Gas-Works, under Mr. Meunier, and held the position till 1909, when he obtained the position at Workington which he is now relinquishing. He is also Consulting Engineer to one or two works in the neighbourhood. In addition to his practical experience in gas manufacture, Mr. Hutchinson has shown himself to be the possessor of the necessary theoretical knowledge. He is the holder of a first-class certificate in "Advanced Chemistry" at the Science and Art Examination, and he passed in "Gas Manufacture" at the City and Guilds of London Examination. He is a member of the Institution of Gas Engineers and also of the Society of Chemical Industry.

A claim against the Slough Urban District Council by the Water Engineer (Mr. J. H. Secker) for £2000 compensation has been settled, by agreement, but without prejudice, at £1500.

THE JUBILEE MEETING

OF THE

INSTITUTION OF GAS ENGINEERS.

JUNE 17 to 19, 1913.

PRESIDENTIAL ADDRESS DELIVERED

BY

SIR CORBET WOODALL, D.Sc., M.Inst.C.E.

Gentlemen,—It is my duty, as it is my great pleasure, to take advantage of this, the first opportune moment, to express my appreciation of the honour you have done me in choosing me for your President during the Jubilee Year of the Institution. The honour that is done one by one's peers and colleagues is amongst the dearest of all. Believe me, there can be few more grateful reflections when well advanced in a long and busy life, than the assurance that those with whom one has dealt most and longest remain one's best friends.

I leave these personal reflections, and pass to another pleasant duty. We are all, as members of this Institution, honoured by the presence to-day, to share our rejoicings, of so goodly a number of visitors from overseas—delegates from sister Societies which, in their turn, followed our example and came before the industrial world as representing the *personnel* of the gas industry in their respective countries. We thank the Societies for sending us representatives so eminent; and we thank the latter, collectively and individually, for their presence here to-day. I hope they may find in our proceedings, as well as in the sincere cordiality of our welcome, some recompense for the trouble they have generously taken. But for the regrettable clashing of dates of meetings, we should have had an even stronger contingent of friendly invaders of these shores, whose native fogs were still the first shades to be lightened by illuminating gas.

The Centenary of Public Gas Lighting.

This reminds me that there has been within the last twelve months a celebration of the centenary of public gas lighting. The Gaslight and Coke Company was one hundred years old last spring. I am fully aware that different countries lay claim to having produced the real invention of gas light, although none of them seemed to be aware or proud of the distinction at the time. History repeats itself; for we know that

> "Seven wealthy towns contend for Homer dead
> Through which the living Homer begged his bread."

There can, however, be no contention as to where arose the pioneer gas company, which had to be laboriously worked into shape before other places thought the venture worth trying. In England, the industry took root in many places very early; but it was some time before it crossed the seas. I do not say this by way of reflecting upon the enterprise of the continental nations; but time was necessary for the Napoleonic terror to pass, and its effects to be repaired, before the largest European cities were ready for development.

Among the earliest towns in Europe to adopt and profit by the new light were many to which it was brought by the enterprise of English companies. It is matter for legitimate pride that of the cities lighted by the Imperial Continental Gas Company, nearly a hundred years ago, some have maintained the connection happily to this day—to the advantage of both parties. Other English gas companies were formed on the same lines, and have I believe much the same experience. The planting and development of the gas industry on the Continent is one of many striking illustrations of the courage with which our forefathers applied British capital and enterprise to the extension of engineering works throughout the world.

The pioneer gas company and its scions had a hard time of it for many years. It would unduly prolong this address to recite all their experiences up to the period when, after fifty years, this Association was founded, in Manchester.

The Beginnings of the Institution.

Here I have to begin my task; for necessarily a Presidential Address for a Jubilee Year of the Society must be mainly retrospective. I trust nevertheless that the chief curse of retrospect—familiarity—will not on this occasion produce the proverbial effect; for there is very much that we can learn from even an imperfect survey of the ground covered by our industry in this period, such as I, who was a gas man when it began, may perhaps succeed to some extent in putting before you. I had not the great good fortune to form one of the little band who, on the auspicious occasion of the formation of the British Association of Gas Managers, gathered round that beloved founder, Dr. Thomas Newbigging, whom we are delighted to have amongst us to-day in health and strength, after a life as strenuous and useful as but few have put to their credit. But I had a brother there; and another brother and I were elected members in 1865. It was a small sapling that was planted, but a vigorous; and it has abundantly justified the hopes, and fulfilled the intentions, of its well-wishers. I find the contemporary record states that we were not the first in the field. It is hardly necessary to say who did get there first—of course, it was a Scot. At Kelso, on April 12, 1862, twenty-two Scottish gas managers foregathered (I trust that is the correct word) with the laudable purpose of forming an Association; and "the business being over, the members dined together." So they knew how to do it, the very first time!

The preliminary meeting of founders of the British Association of Gas Managers took place in Manchester on Dec. 15, 1863. Dr. Newbigging is the sole survivor of that little company. They decided to hold the first regular meeting of the Association then and there formed, on May 11 following, which meeting was held accordingly. Very familiar to the seniors amongst us sound the names of the members. The first President, Thomas Hawksley, whose distinguished son is one of our number to-day; T. G. Barlow, the Vice-President—founder of the "Journal of Gas Lighting;" Ebenezer Goddard, whose name still spells Ipswich; S. P. Leather, of Burnley—there is yet a scion there; genial old Peter Simpson, of Rugby; Thornton Andrews, of Swansea; John Hutchinson, of Barnsley—still represented at the same address; James Paterson, of Warrington—another name happily perpetuated in our ranks; William Woodall; and, as before mentioned, Thomas Newbigging, who I venture to say has more friends in the Institution now than ever. There were giants in the land in those days. The redoubtable Dr. Letheby was our prophet, with Dr. Edward Frankland, a good second. Abroad, France produced as leaders of the industry, M. Arson and M. Ellissen, who were amongst the first to bring the fine French science to bear upon the problems of gas manufacture and distribution, in which it has found such fruitful employment. Germany had its Dr. Schilling and Dr. Bunte, to whose labours in its

interest the gas industry of the world is more indebted than I can say.

The Professional and Commercial Organization of the Industry.

Among the most important and interesting developments of the personal relations of the members of our branch of the profession of civil engineering as well as of the followers of the industry during the lifetime, and doubtless instigated by the example of, this Institution, must be mentioned the District Associations, with their valuable Commercial Sections, from which has sprung as a vigorous offshoot that remarkably active and efficient organization, the British Commercial Gas Association, which has already made a deep impression upon the public served by ourselves and our competitors. I trust that this commercial agency of ours will go on flourishing, and drawing to itself an ever-increasing measure of support, which I am sure it well deserves. There is also the Society of British Gas Industries, with a sphere of its own, in which it should do much good, provided it is faithful to the aims of its founders, avoiding the pitfalls that so easily occur in the way of trades councils, whether of employers or of workmen. I hope that the forces that would draw these various societies and this Institution together, for the common good, will always prove stronger than the others—obvious enough—which would set any of them in opposition to the rest. All are so far working harmoniously together; and the united endeavour to make the forthcoming Jubilee Gas Exhibition an outstanding success has been very pleasing to witness. I trust that when this temporary common concern has passed, the future of all the organizations may be safely entrusted to the operation of the feeling for fellowship which is growing stronger alongside the specializing tendency of the age. All feel the need of countenance and companionship in the walk through life. Our own calling unavoidably separates and scatters its followers over the face of the earth; and therefore it is the more incumbent upon us to form and keep alive those pleasant links of comradeship such as our Institution and its allied societies offer. Let us hold together in support of our mutual societies, and make the most and the best use of them for the advancement of our place in the world. This, too, is to do the commonwealth good service; for as Francis Bacon saith—

> I hold every man a debtor to his profession, from the which as men do of course seek to receive countenance and support, so ought they of duty to endeavour themselves by way of amends to be a help and ornament thereunto.

In an Age of Competition.

It was a rather lively world into which the Association was born. Competition in gas supply was in the air; and the professional gas agitator was one of the plagues of the land. He would not let the established companies divide their 10 per cent. in peace, but was always starting "new," "consumers," or "equitable" gas companies, whenever the established undertakings had arrived at the point of being able to declare the maximum dividend. Or he was moving the local authorities to enter into competition with the old companies. The reason for this incessant turmoil lay in the common public opinion that commercial competition is the only way to keep down prices—which is only too true of trade in general. Like all the generalizations of political economy, however, it is open to test by the exceptions. Such an exception is the supply of a town district with gas or water, involving the sinking of a large proportion of the total capital in the distributing plant. In such case, a second company not only adds greatly to the capital expenditure, but duplicates administrative and management expenses to no advantage, but rather to the permanent enhancement of the cost of the service. The British public did not grasp this truth; though in point of fact many considerable towns in the kingdom at this period were being supplied with gas by companies that had absorbed a rival or two in the course of their career. Unfortunately, these surviving companies generally did not, so far as I am aware, apply some portion of their increasing profits to wipe off the burden of dead capital. Therefore, the quite reasonable 10 per cent. maximum dividend, which would have sat lightly enough upon an unencumbered gas company, proved a cause of strife when paid equally upon capital unrepresented by assets. Also, unfortunately, there was no efficient machinery for ensuring that capital and revenue charges should be justly apportioned. This looseness, coupled with the liberty to issue fresh capital, at par, to the existing proprietors sufficiently accounts for the more reasonable gas agitations of the period. I presume that one may without offence, after this lapse of time, admit that the advent of the Great Central Gas Company into the coterie of the older London gas undertakings was justified by the circumstances. However this may have been, we soon find all the London gas companies amicably dividing up their territories under the patronage of Parliament, and selling common coal gas at the uniform price of 4s. 6d. per 1000 cubic feet. This was at the period when the British Association came to town.

The Districting of the London Gas Companies.

The districting of the Metropolitan companies, although necessarily resulting in economy, and incidentally barring the door to all speculative gas competition for the future, failed to bring peace to the companies or satisfaction to the public. This persistence of trouble was no doubt partly due to the short-sighted policy of some of the companies, in ignoring their overload of capital, and applying the increase of profit to the paying of back-dividends and bonuses. Consequently, the City Corporation and the Metropolitan Board of Works were continually being moved to undertake the gas supply in one way or another—either in competition or by purchase—when the source of the trouble was more effectively attacked in other ways, both in town and country. Gradually the idea gained ground that concentration, rather than division, made for the good of the public service. It was observed at length that hopes of cheapening the supply by competition were never realized; but that sooner or later the competitors agreed, when the public was obliged as I have said to pay for two capitals instead of one. In the absence of any provision for reducing the capital, it was at least feasible to lessen working expenses by fusion, and thus the amalgamation policy was accepted.

Meanwhile, the Gas-Works Clauses Act, 1871, was passed. It introduced the provision of compulsory supply to householders in the district; prescribed the publication of accounts in a specified form; and made regulations for testing the gas in the absence of special provisions in the Private Act. This General Act went a long way to allay popular suspicion of the good faith of provincial gas undertakings; but it had little effect in London, where the municipal authorities continued to vex the companies. Finally, opinion crystallized into the conviction that it was the 10 per cent. (or any less maximum dividend) which was the source and origin of whatever was wrong in the financial and commercial constitution and business habits of protected companies.

The Introduction of the Sliding Scale.

Then arose the man who proved to be the saviour of the situation, who could and did remodel the gas finance of the country, and bring about a new settlement, under which the land has had peace for the lifetime of a generation. This was the late Sir George Livesey, whose name can never be spoken without reverence in such a gathering as this. I desire to take this opportunity—and such must be rare for me henceforward—to speak my deep appreciation of him, who made the greatest name in the history of our industry while he was a member of this body, for the devotion and understanding which he gave to its protection and advancement. That the national gas industry is so flourishing as it is to-day, is due to him more than to any other man. He went with all the force of his extraordinarily powerful personality, all the power of his exceptional intellect, and a sincere singleness of purpose which carried away all obstacles, straight to the mark of the best service to the community. Firmly believing, as he was always ready to maintain, that cheap gas is the main inducement to increased consumption, and that increase of consumption reacts upon, and reduces, the cost of production, he accepted the sliding scale of price and dividend as the most effectual means to that end. It mattered not a jot to him that those of the old order, who saw in every reduction of the price gas a jeopardizing of their dividend, rose up and reviled him. He could afford to laugh at their fears—he was himself a large gas shareholder. Many of his opponents were

simply incapable to the close of their lives of grasping the idea that the way to preserve, and eventually increase, dividends was to make consumers parties in the prosperity of the companies.

It is a matter of history that the opening for the reform of the whole system of gas finance was made by the Metropolitan Board of Works, in the course of their incessant attacks upon the London companies, when they made the proposal that, instead of being free to put up the price of gas, whenever it was thought necessary to ensure the maximum dividends, this step should be countered by a reduction of the permitted rate of dividend. Hereupon Mr. Livesey proposed as an amendment that the adjustment should cut both ways. This was approved of as fair and just by Lord Farrer, of the Board of Trade, and was first adopted by the Commercial Gas Company in 1875. To cut a long story short, this organic reform put new life into the gas industry of the whole country. Our critics are accustomed to say that the invention by Ritter von Welsbach, in 1885, of the incandescent gas-light preserved the gas industry. This is a very partial and imperfect explanation of the facts. It was George Livesey who opened out the future of the industry ten years earlier. He prepared it not only for the improved burners which were still hidden in the future, but also made it possible for it to branch out, when the time came, into the untried but most fruitful fields of domestic cooking and house warming, and the use of gas as an industrial fuel. Without cheaper gas, little of this development would have been possible. Without the inducement of the sliding scale, there was little to spur on the companies to lower the price. He yoked pecuniary interest to public duty, and the team went ahead at a speed never before approached.

The Era of "Candle-Power."

When this Association was formed, hardly a soul anticipated the largest of the modern developments of the business. Mr. Sharpe, at Southampton, was as a voice crying in the wilderness the possibilities of cooking by gas; and I believe there was an echo from Maidstone. Mr. J. O. N. Rutter, at Brighton, was endeavouring to interest a callous world in the merits of gas, which nobody dreamed of buying for anything else besides the lighting of his premises. To be a gas consumer in those days was almost as good a mark of respectability as keeping a gig. Illuminating power was the sole standard of quality for gas, in addition to purification from sulphuretted hydrogen. Cannel gas might run as high as 32 or 33 candles in Edinburgh, which had the reputation at the same time of being one of the worst lighted cities in Europe. In London, there was a modicum of 20-candle gas in the West end; and the rest was either 16 or 14 candle "common coal gas." Even so, much trouble was experienced in working to the standard; and the annual consumption of cannel, chiefly for gas enrichment, was as high as 1½ million tons. By the early sixties, the price of this luxury had doubled; and misgivings as to the duration of the supply were already in the air. In 1866, a Government geologist reported that, at the then rate of output, the cannel coal deposits would be exhausted in thirty-three years. Gas politicians began to wonder what would happen then. So prone is man to disquiet himself in vain! Before the allotted period arrived, the enrichment of common coal gas by means of cannel had ceased.

Commissions sat to determine "what is a candle," and how the candle power of a gas-flame should be ascertained. Incidentally, these investigations produced a good deal of valuable information relating to the phenomena of luminous combustion. But, in the meantime, the public went on burning their gas by the agency of such burners as would barely yield one-half the nominal luminosity given to the gas at such heavy cost. In my opinion, the time has fully arrived when a definite change should be made in the standard by which the value of gas is determined. When nearly the whole of the gas sold is used for purposes where the luminosity of the flame is of negligible importance, it is clear that a test which only determines that element is an obsolete one. As the consumer is interested only in the heating value of what is supplied to him, it is heating value that should be determined by the test. I trust that next session may see an earnest and continued effort to effect this necessary reform. In regard to the sulphur question, great expense was also incurred, and an infinity of worry endured, in the endeavour to satisfy an arbitrary standard of relative purity. Although these difficulties were of metropolitan origin, they naturally spread over the country wherever interest in such matters penetrated. One remarkable fact was that they never assumed any importance in connection with municipalized gas supply. If this Manchester-born Association had preserved the traditions of its birthplace, it would have given small attention to such vanities as statutory illuminating power, or "sulphur" purification.

Before leaving this subject, I must pay the acknowledgment due to Mr. Vernon Harcourt for his successful solution of the problem of finding a reproducible candle-power standard of light for photometrical purposes, and to Dr. Charles Carpenter for his service to the gas industry in giving us a scientific, trustworthy standard test-burner for gas of the common coal grades.

The problem of thorough sulphur purification remains to be solved; and it is impossible to compliment chemical science upon the progress made towards this desirable consummation during the last forty or fifty years—that is to say, for so long as the question has been definitely formulated. Thanks again largely to Sir George Livesey, this responsibility does not weigh quite so irksomely upon London Gas Companies as it did. But, morally and as a matter of sound business, they are much concerned to keep the sulphur down to its lowest limits. It is just the half-century ago that the patent of F. C. Hills for iron oxide purification with revivification expired, and common coal gas makers were set free to deal with sulphuretted hydrogen with perfect ease, security, and economy. They were left with gas containing an apparently irreducible margin of sulphur impurity in other forms—at that period, amounting (say) to about 20 grains in 100 cubic feet. The whole of this was believed to exist in obscure organic forms, possessing no chemical affinity with any known substance which might in such case be employed to absorb them. As carbonization in clay retorts at high heats superseded iron retorts and built-up ovens (both worked at comparatively low temperatures), the sulphur increased, in the form of bisulphide of carbon; amounting on the average to about 40 grains per 100 cubic feet. By the lime process with which the name of one of the original Gas Referees, Mr. R. H. Patterson, is identified, this part of the sulphur can be more or less arrested; but very few gas undertakings adopted this treatment unless under compulsion. Recently, as I have said, the London companies were relieved from their exceptional obligations in this respect; but it has been found that the sulphur has risen beyond the old figures, for a variety of reasons which cannot well be detailed in this address. We hope the renewed efforts which are in progress in several directions, with the object of solving this difficulty, will shortly be crowned with success.

I have mentioned the change of method in carbonizing coal for the production of gas, which came in about the time this Society was formed. Clay retorts ("throughs" for choice) and exhausters were introduced at this period into many gas-works, though short clay retorts and shovel charging held their own for years in some quite large works. Very little idea of machine stoking for such carbonizing units was entertained. Yet here and there, as reference to "Clegg's Treatise" shows, the notion of somehow working the carbonizing plant mechanically was always stirring in some shape. It would be tedious to even enumerate the attempts in this direction which either never materialized, or else had a brief and troubled life. In course of time, a practical success was earned by our respected colleague, Mr. John West, in simply helping the stoker to do his work less laboriously; and thereafter mechanical progress has never stayed. Retort-houses now are very different affairs from the simple "ground-floor" sheds for retorts they were in the sixties. They are power stations; and I think that some of our rivals, who scarcely admit that gas engineering is engineering at all, would be surprised by a visit to such an establishment.

This is where our Continental and American colleagues gave us a good lead. Germany gave us gaseous firing for our retort-benches, which owed its general adoption to the pioneer work of Dr. Bunte. This innovation has been followed up with the vertical (intermittent) retort, and with a large family of retort coke-ovens. France gave us the inclined retort. America has sent us the carburetted water gas system. Indeed, amidst all this welter of novelties from abroad, it was difficult to find anything British able to hold

its own. But this leeway, such as it was, has I think been largely made up.

The University of Leeds and the Institution.

The institution of the Livesey Professorship of Coal Gas and Fuel Industries in the University of Leeds was a departure of great importance in relation to our profession, providing as it did for the first time a course of study of University standing for gas engineers, such as has long been in existence for those devoting themselves to mechanical, civil, and electrical engineering, and to other industrial pursuits, in which a wide and thorough knowledge of science adds so largely to a man's equipment for intelligent and successful effort. The English genius is no doubt practical rather than theoretical; and there is hesitation felt in departing from the old ways and allowing a young man the time to pursue the study of theoretical foundations when he might be gaining knowledge of the actual practice of his profession. But all the signs of the times point to the increasing importance of scientific knowledge for the furtherance of our industry; and I do not doubt that the authorities of the Leeds University will find a continually improving response to the opportunities they offer to our young men.

The difficulties of teaching Applied Science in such a way as to satisfy at the same time the reasonable educational demand for sound foundations and the professional demand for knowledge that is really and effectively specialized, are very great, and can only be solved by experience. The difficulty of finding men equally qualified in scientific knowledge, and in practical experience, as well as endowed with the gifts of the teacher, is also very great. We must remember that the University may provide gifted teachers, equip fine laboratories, and devise excellent courses of study, but that these will avail nothing unless we are prepared to give them the material on which to work, in the form of students.

The Fellowship which this Institution has offered in the University of Leeds gives a most valuable opportunity to a qualified student to become initiated in the work of scientific investigation and to develop his powers of originality. At the present time the investigation which, under Professor Cobb's guidance, is being conducted by the Research Fellow, Mr. Hollings, is of two kinds. In the first place a study is being made of the thermal phenomena attending the carbonization of coal, with a view to dividing the process into stages which can then be studied with advantage from the chemical standpoint. Work is also being carried out in another direction, with a view to elucidating the changes which occur in the gaseous products of carbonization when subjected to the influence of a column of hot coke at various temperatures, and also when subjected to the influence of direct radiation from heated surfaces. It is hoped that both these lines of work will result in the acquisition of positive knowledge of practical importance in relation to the carbonization of coal. A preliminary report on them has already been made to the Council of the Institution.

The Rule of High Carbonization.

The broad lines of the gas industry remain as they were laid down by Samuel Clegg, not fifty but a hundred years ago. They may be summed up in two words—"High Carbonization." Those who have access to Accum's "Treatise on Coal Gas" will find in it Clegg's demonstration that a high yield of gas is the most profitable aim of the gas manager. It is a lesson which has been taught since then over and over again by costly experience. Yet there appears to be some perennial attraction in the idea of low carbonization, with its production of everything that is desirable, except gas suitable for town consumption. Some admire it for the sake of soft flaming coke; others for the higher yield of ammonia; others, again, for the liquid products. Such promise as it might have offered many years ago, when the candle power of gas was over-valued, has vanished with the coming of light gas, more esteemed for its calorific power than for its flame luminosity. This change of values is the greatest our manufacture has ever sustained; yet it has left the principles of gas production unaltered. The operation is modified and multiplied, and various types of retorts have been introduced. But the object is the same. We have adopted a new standard of carbonizing—no longer an artificial one, but a natural and local one, depending chiefly upon the capability ot our available coal and the real requirements of our customers. We have ceased to adulterate our output with a view of passing an obsolete test. Yet not a single piece of plant need be prematurely scrapped in consequence; not a sovereign of capital be rendered unprofitable.

What has happened is that by the invention of Von Welsbach the production of light from gas, vastly in excess of its illuminating power as understood before 1885, has assimilated this use of gas with its applications to cooking, heating, as industrial fuel, and for the production of motive power. Whereas, before this epoch, these latter uses of gas, which bulked larger every year, might be classified independently of, and even in certain circumstances antagonistically to, lighting gas—you will remember that the suggestion to distribute two grades or sorts of gas had repeatedly cropped up, and in America was tried with disastrous results—Welsbach's triumph placed all town's gas in the same class. A new measure of its quality then emerged, and men began to talk about its calorific power and flame temperature. The chief novelty of the latter quarter of the last century—carburetted water gas (originally introduced for the purpose of enrichment and as a substitute for cannel)—has proved to be equally adaptable to the production of light gas in bulk; and how precious this elasticity proved during the coal strike of last year, it would be difficult to convey in words.

I am afraid this cursive review of the development of our industry through half-a-century has been partial, and not so well ordered as I could wish; but my excuse for all omissions and shortcomings of detail must be that I am desirous of arriving at a definition of what I conceive to be the actual position of our industry in the national economy. I desire to place on record the broad results of a technical progress which—without a preconceived plan, occasionally by apparently accidental aid from outside, in face of oppositions and drawbacks of varied character, and in the cold shade of neglect by fashionable science—has lifted a trade in a particular kind of artificial light into an indispensable public supply service, having to its credit the utmost husbandry of the national coal asset, and a large potentiality in regard to the improvement of town hygiene.

Town Gas and its Rivals.

It is human nature to look afar for means of satisfying newly-felt wants. Therefore it is not surprising that time and again, as the waste of coal in household consumption has been pointed out, and the undesirable accompaniments of this waste in the forms of smoky atmospheres, dirty coal traffic in the streets, objectionable housework, and so forth, have struck the public mind, suggestions more or less far-fetched should be offered for preventing this waste, and improving the domestic heating service of towns. Most propositions of the kind were for something "in bulk"—usually quite speculative and untried. That there could be pitfalls in the way of such amateurish schemes was not feared. London was to be tackled first. A supply of light, heat, and power was to be brought in from the pit's mouth somewhere, or from the bottom of the pit. The fuel would be something gaseous; and the light, in recent years at least, would be wholly electrical. Eventually, the power was to be electrical also. Even those framers of schemes of the kind who had a notion that gas manufacture as already carried on was the most economical way of treating coal, scorned our Becktons and East Greenwiches, and wanted something on a very much grander scale at an unspecified spot, vaguely described as "the coalfields."

The idea that there would be advantage in overleaping all experience, and making provision for an immense extraneous supply to London of electricity-in-bulk, unconnected with any particular application in detail of general distribution, was much discussed a few years ago. There was no effective demand, however, and consequently the proposition remained in the air until it evaporated. We have in actual existence several big electricity generating stations, with real work to do; but I am not aware that sound engineering opinion is much in love with mere size in these matters. Steam power plant does not necessarily become more economical of fuel with bigness; and the largest units give the most trouble when anything goes wrong. Of course, I am not going to criticize the electric lighting and power undertakings of the Metropolis. In the economical use of fuel, however, electricity is neither better nor worse than any system which begins with steam power.

Let it not be forgotten that distributed hydraulic power

is, in its proper sphere, of unequalled value. It is capable of performing services which no other form of distributed power can furnish, and, in its contribution to the purifying of the atmosphere of towns it is equal, in its measure, to either gas or electricity.

The term "fuel gas" denotes a gaseous form of combustible, different from that manufactured in gas-works for public consumption. It does not mean the gas recovered from coking plants, large quantities of which are actually being purchased by the gas undertakings of towns conveniently situated for the purpose. Such gas is of the same nature as our own manufacture; and, indeed, in Birmingham and elsewhere coke-ovens are being employed at the gas-works because there is a local market for the hard metallurgical description of coke. I hail all such developments, which bring the keen, bracing air of ordinary business across what used to be the close preserve of a statutory undertaking. Every proposition of the kind requires to be dealt with on its merits. There is no general rule, other than that of finding out what the public wants, and supplying it. "Fuel gas"—that is to say "producer" gas—it has been proposed to generate in bulk, and pipe any distance to town. The objection to such a proposal, apart from every other consideration, is that there is no use for it in town districts. It is commercially impracticable to purify it; and, therefore, it is unfit for domestic use. Its flame temperature is low; consequently it is unsuitable for most industrial applications well served by town's gas.

Recently, an impetus has been imparted to the "Mond" variety of producer gas by the high market price of sulphate of ammonia; and it appears feasible that some gas-works might find it worth while to sell the whole of their coke, make Mond gas in suitable producers, and heat their furnaces with the washed gas. As to converted coal—meaning soft coke—it is difficult to concede to this manufacture a sound economic standing. The difficulty is to find a market for such a form of fuel at a paying price, to cover the value of the gas sacrificed, and also the extra cost of handling the light and friable material.

There remains town's gas, made straight from the most suitable coal for the district, with or without the aid of carburetted water gas, as circumstances may dictate. It meets all needs. It is practically the only gaseous fuel distributable for every purpose of such a fuel, and competent to provide light, heat, or power. It is subject to no loss by conversion, like the enormous waste of the generation of motive power from coal, or the heavy heat loss of the "producer." So far as science enables us to test the question, by this means alone can the huge domestic squandering of coal be checked, and the smoke nuisance of towns dispelled. All I would plead for, with those in authority over such matters, is that this newly reborn industry—this freshly-equipped public supply service—should be given a fair field. It asks no favours. Let no obsolete restrictions hamper its growth. Tell the people about it; let them have it at the cheapest rate; and show them how to use it. I would appeal specially to all municipal corporations entrusted with this potent service of an advanced civilization, to cease bleeding it for current expenses properly chargeable to all the population. Think of the future; and redeem indebtedness. The time may—nay, will—come when the cost of materials and working will show a substantial rise; and then the places where true husbandry has been practised will have the call of those that have misused their opportunity. This is the proper way of making gas "profits" aid the rates—by discounting the burdens of the future.

Rise of the Outdoor Service.

The greatest modern change noticeable in the internal economy of gas undertakings is the increased importance of the Outdoor, now frequently re-named the Gas Sales, Department. Fifty years ago there could have been no such department, because the sale of gas had not emerged from the primitive order of a "rental of light." There were in the land tradesmen called gasfitters, whose work began at the main-cock on the service, where the company left off. When, about 1880, the gas companies began to adopt the policy of hiring-out cooking stoves, they entered upon a career of commercial enterprise in which their command of capital gradually led them to a position of practical monopoly of the whole gasfitting trade. This was not their intention; but the force of circumstances proved too strong for their original reserve. The introduction of the prepayment meter system shortly afterwards gave an additional impetus to this development; and the necessity for a complete maintenance system rounded it off.

Personally, I cannot shed a tear over the disappearance of the once-familiar "three-branch hand;" but I would lay all possible stress upon the gas companies' obligation to do the work better. It does not follow that a good works' manager is also a born master-gasfitter, plumber, and hot-water expert. Neither is it the correct thing to make a position for a sales superintendent, and leave it all to him. There ought to be a good understanding between the manager and his outdoor lieutenant; and between them they should make themselves thoroughly acquainted with every piece of consumers' apparatus taken into use. We should then hear less of unsatisfactory fires and disappointing lamps; and the superfluous multiplication of patterns for no sound reason will be checked. This, by the way, is a crying necessity; and I would commend to the attention of the Council of the Institution the consideration of the possibilities of standardizing in this class of supplies. We shall derive help in the study of this subject from the paper Mr. Goodenough will contribute to our proceedings.

There is a whole department of our present-day practice which has come into existence since the foundation of this Institution. I speak of high-pressure practice in gas transmission, distribution, and application to lighting and heating. Very naturally, so interesting a branch of technics has often figured in our "Transactions." Its practice falls into the three divisions I have mentioned, which have no necessary connection with one another. High-pressure transmission comes first in order of time, and also of magnitude. It is usually thought of as an American speciality, called into existence in order to cope with the necessity of conveying natural gas to great distances. Although there is more work of this kind done in the United States than elsewhere (for good and sufficient reasons), in point of fact the plan was devised and first put into operation in Liverpool, by Mr. William King, to connect two gas-works. This was as long ago as 1867. Next it was adopted at Beckton, in order to transmit the gas made there to London. Another English example was at Preston. In later years the expedient has been followed in a great number of situations, I believe with uniform success. The only matter left obscure in this respect seems to be the mathematical expression for the rate of delivery of the pipe-line.

High-pressure distribution differs from transmission in several respects. It is directly related to the consumption, or the applications of the gas, collectively or individually, in the district. This consideration, therefore, dictates the conditions to be satisfied by the engineer. I am under the impression that the first considerable experiment in reinforcing the ordinary district main pressure by mechanical power was instituted by Sir George Livesey, in order to supply from the Old Kent Road works the heaviest hours' demand of the fast-developing, low-lying region around Clapham Junction, without the expense and delay of a new trunk main. The possibility of such an expedient, of course, depends upon the fact of ordinary gas-mains being capable of carrying very much more gas, at a push, than they do at the usual small pressure-heads. This "boosting" practice has been very widely adopted also to draw off the contents of light holders. It is essentially intermittent in operation. There is another variety of high-pressure distribution (in which the determined head of pressure is constant), enabling supplies at the same or anything lower to be given direct to public or private lamps, or industrial furnaces. This is, properly speaking, high-pressure gas-supply; and it has its own particular technical object—namely, the increased primary aëration of the gas in the bunsen burner, and the resultant higher temperature of the flame.

The Uses of High-Pressure Gas.

The earliest form of high-pressure incandescent lighting burner and apparatus was, I believe, devised by a Belgian gas engineer, M. Greyson de Schodt, about 1896. The burner and apparatus were crude, but gave such an indication of what might be achieved by increasing pressure that improvements were rapidly effected. Much valuable work in this direction was done in this country by the late Mr. William Sugg and by Mr. Keith; while much attention was also paid to high-pressure development in Germany.

For the first ten years—that is until 1907—high-pressure was only utilized for lighting purposes in upright burners. In 1907, an inverted burner was put on the market, which increased the efficiency from about 35 to between 60 and 70 candles per cubic foot of gas consumption per hour. Not only was the efficiency per cubic foot thus increased, but the inverted burner also made it possible to obtain much larger units of light per mantle than had hitherto been possible. The gas industry was thereby armed with a weapon capable of competing in magnitude of light units with the flame arc lamp that was introduced about the same time.

High-pressure gas has been widely adopted for the lighting of factories and workshops and also for the public lighting of main thoroughfares. London affords a good example of this later application of high-pressure gas lighting in the series of streets in the City of Westminster, the Borough of Holborn, and the City of London, which are lighted by lamps supplied with gas under pressure from plant installed at Horseferry Road. I need hardly tell this audience that many equally admirable examples are to be seen elsewhere in London, as also in its suburbs and in the provinces.

High-pressure gas lighting has also been adopted to a very considerable extent for the lighting of large blocks of shops; the lighting being charged to the shop-keepers at prices per lamp per annum (varying according to the desired hours of lighting) which include the rent of plant and maintenance of lamps, as well as the gas consumed. This arrangement, whereby the consumer pays an inclusive price per lamp per annum, and is relieved of all trouble in connection with installation and upkeep, has proved very popular, and has brightened-up many a shopping centre.

I have had the figures taken out for four of the Gaslight and Coke Company's installations (comprising 883 lamps, giving a total of 745,000 candle power); and I find that with a gross revenue of £4837, there is a net revenue for gas—after providing for interest and amortization of capital, and the cost of all maintenance, lighting, extinguishing, and running of compressing plant—of £1474, giving a net return of a fraction of a penny under 2s. per 1000 cubic feet in respect of the gas consumed. This is, therefore, a system for the co-operative outside lighting of business premises that is both satisfactory to the consumer and profitable to the supplier of gas.

Mention should be made of the rapidly extending use of high-pressure gas for industrial heating purposes. Great developments in this direction have taken place in the industrial centres of this country during recent years—notably in Birmingham, Newcastle, and Sheffield. In Birmingham, a high-pressure main has been laid for distributing over a large area gas at 15 lbs. per square inch, principally for use as fuel in the factories of the city.

While referring to the advantage which has accrued to the gas industry from the introduction of the use of gas under pressure, it is well to mention also the advance that has taken place in recent years in the efficiency obtained from gas under low pressure; many of the inverted burner lamps of from 500 to 1000 candle power which have been put on the market during recent years having a considerably higher efficiency per cubic foot of gas consumed than the smaller inverted burners. This makes it necessary always to draw up a careful balance-sheet of the total cost per candle power required, taking all factors of capital and running cost into account, before deciding whether to adopt a high or a low pressure system of lighting. The higher the price of gas, the stronger the case for the use of increased pressure, which economizes in gas consumption while being more expensive in annual and running costs.

The history of the development of gas lighting during the last fifteen years undoubtedly warrants the belief that we have by no means reached finality in regard to the amount of light to be obtained per cubic foot of gas consumed.

I do not forget that this intensification of the flame action is also attainable by other means—such as the use of air under pressure, and individual lamp mechanism. But, from the point of view of a gas company, high-pressure gas is the most convenient means to the end.

It is this constant development on both sides that makes the competition between gas and electricity for lighting such a fascinating study. In such competition as there is (and it is not of a serious nature) between gas and electricity for heating, the problem is only one of the conservation of the heat produced; the relative heating values of gas and electricity being absolute, and incapable of change other than by alteration of the calorific power of the gas supplied.

In regard to lighting, the problem is one of transforming heat into light; and we have no means of determining what are the final possibilities in regard to the development of light from potential energy, whether that energy be in the form of electric current or of flame produced by the combustion of coal gas. We have seen the light obtainable from a cubic foot of gas increase from two to sixty candles in the years that have passed. Who is to say that we shall not see the sixty improved upon considerably in the years that lie before us?

This leads me to such brief reflection as I can spare for the science of the phenomena of gas combustion at different velocities of flow, which is what is involved in the use of various heads of pressure. It is surprising that this problem has not been worked out into a helpful theory, such as plain men could understand. All practical applications of gas to useful purposes have been what is politely styled empiric. That means, in plain language, "trial and error." Working from a few data, as that the flow of gas under pressure into the atmosphere is as the square root of the head, and guiding himself by what he knew of the laws of free-burning flames, men like the late A. W. Onslow (whose loss we deplore) achieved certain results. It is all so tentative, and the reasons given for this or that device or process are so frankly experimental, that one cannot be sure of one's ground. At least, this is my mental attitude regarding the phenomena; and I should prefer more light upon the physics of the matter.

Of the Men of the Industry.

I hope it is not presumptuous on my part to say that I see a great difference for the better in the personality of the industry, compared with what I remember of an earlier day. There has been an advance all through, from the labourer upwards.

Looking back (say) thirty years, those of us who were then old enough to be in active charge of gas-works will remember the anxiety—I might say, the disgust—with which we regarded each week-end. Men who were excellent and dependable workers through the rest of the week would either be absent, or present themselves in a condition which made them a danger to themselves and to others. Not infrequently plant was rendered idle to an extent which interfered with the adequate supply of the district. The wages then were lower relatively to the cost of living than they are now; but the proportion spent on drink was far greater.

What a change from this is our present-day experience! Throughout the country, I believe (certainly in London, so far as my observation goes), the drink trouble has absolutely vanished, and the men's attendance is in no way affected by the recurrence of pay day. This reform is due, doubtless, to the better education of recent years, not only of the men themselves, but also of their children, who bring into the home an atmosphere in which the old coarseness of life does not thrive. Fifty years ago, for men living in towns the only place of amusement or recreation (so-called) was the public-house, which was always open. Very few places offered allotment gardens in order to profitably occupy the spare time of working men; and of free libraries and reading-rooms, or the power to make use of them, there was no sign.

Evidence of another kind, but to the same purport, is to be found in the accommodation provided in most gas-works for the health, comfort, and convenience of the men, which is often of a superior order. Rooms for dining, bathing, dressing, games, and simple rest are general. So also is the provision for old age by way of pensions; holidays with payment—the same for Territorials; games grounds; and aids to thrift. Many of these ameliorations are of recent date; but regarded in the mass, and over the stretch of fifty years, the advances are little short of wonderful.

The formation of associations of workmen, with the accompanying development of the sense of common interests, experience of power, and the responsibility attaching to its exercise, have been strongly stimulating to the workman's intelligence, and the substitution of machinery for the heaviest kinds of hand labour has aided this movement. Such changes of method, whereby a premium is put upon brains and character, in preference to brute strength, have involved a change of outlook on the part of the workman, not only in our own industry but generally. As a consequence, the pendulum shows a tendency to swing far in the

opposite direction to that originally occupied. "The old order changeth, yielding place to new."

Concerning Co-Partnership.

It is, I think, impossible for any observant person to watch the features and incidents of the industrial question, as they are daily, almost hourly, reported in the newspapers, without acquiring an uncomfortable impression that this department of our social organization is painfully out-of-joint. Nothing seems certain in the world of industry at large except strikes and rumours of strikes, conciliations that do not seem to stand any strain, revolts of trade unionists against free labour, wars of trade union against trade union. Here we find employers banned for refusing to "recognize" unions; there employers who because they have done so find themselves burdened, not merely, like the unfortunate Sinbad, with one Old Man of the Sea, but with several. It is apparently as bad, or worse, to "recognize" the wrong trade union as to turn a blind eye to all. Trade unions themselves cannot keep peace in their households. It is all a vortex of strife, dissatisfaction, disappointment, and all the ills, in short, that go to discredit the present stage of civilization.

The fountain and source of most of this industrial unrest is the wages system, or rather, let us say, the abuses which have encrusted and corroded the original idea of the payment of a fair day's money for a fair day's work. The bargain has been lop-sided, with a bias now on one side, now on the other. The shifting power in the case is known as the law of supply and demand; and the law-giver is "Necessity." Up to a point in historic time, and at all times up to a variable level of equality of power, the wage-payer has had the upper hand. That he often abused his advantage, there can be no dispute, in view of the history of the Factory Acts, the condition of the agricultural labourer in the time of landlords' and farmers' prosperity, and the present existence of "sweated employments." When an employer can say to an applicant for work: "This is my rate of pay; take it or leave it, there are plenty who'll jump at it," it is an abuse of language to describe it as equal bargaining.

This is rather the condition that renders possible the wrong poetically described as "Grinding the faces of the poor;" or, less elegantly, "Sweating the worker." Indeed, so far as I understand the term, a sweated industry is simply an employment in which the paymaster has a call over those who are willing to work which is scarcely limited at the brink of the workers' starvation, because the value of the labour is liable to be depressed by willingness to accept almost anything on the part of some who are not really dependent upon their earnings for a livelihood.

With the exception of the weaker classes of labour, which for various reasons we shall always have with us in every social grade, the call of labour for better remuneration has risen of late years above the power of the employer to control—arbitrarily, that is to say. Of course, if the job is not worth the money, there can be no deal. Short of this limitation, however, there should be no difficulty in working a wages system upon a fair basis of mutual advantage. Yet it is just here that the facts belie the theory. In order for economic science to produce results, it must have the data and agents it assumes; and of these assumptions the most important is that the labour in the case shall be inspired by, and work upon, economic principles. Is it? Does it? Hear the evidence.

Recently, orders for a number of large steamships were placed out of this country by British shipowners. This was no exceptional case, although the size of the particular transaction arrested public attention. More than a year before, it had been pointed out publicly that the late delivery of British-built ships was driving construction out of the country. The workmen were making too much money, and consequently would not work full time. This has gone on until, as a "Times" correspondent put it:

> "There is another condition which operates against quick delivery; the scale of wages to the men employed is, as is well known, very much higher than that of even two years ago, and the men in many instances—notably that of riveters—earn as much now in four days as they used to earn in five-and-a-half days. If they worked the full week, they would benefit themselves, their employers, and owners. Unfortunately for all parties, this does not suit the men. On the contrary, the majority of such men refuse to work more than the four days; the spirit of thrift or economy being, except in isolated cases, unknown, or, if known, despised by them. Overtime is tabooed by the various unions.
>
> "I have little doubt that the chief reason for the placing of orders with French builders is the much greater reliance that can be put upon date of delivery, as the French workmen welcome busy times as enabling them to add to their savings, whereas the British workmen welcome them as giving them the means to spend money on personal entertainment, to gratify which they utilize the time when they could be earning further wages for the good of themselves, their families, and the community in general."

Now, here is an uneconomical proceeding, which upsets all argument that good wages produce good work. The effect is very human, of course; but the fact amounts to a total failure of the wages system to evolve an "economic" workman. From the thrift point of view, therefore, the wage system is often disappointing. Also, the worker who takes no care for his own morrow, and will not appropriate for himself a reasonable share of the good that is offered to him, is an unprofitable servant of the commonwealth.

The riveter who wantonly "holds up" a badly-needed cargo ship or tank steamer, the collier who banks less coal than he might without distressing himself, the bricklayer who will only lay in a day half the number of bricks that he knows is a fair day's work—all are decreasing the output from the value of which their own wages are derived, and increasing the cost of living to the whole community, including themselves. So the cry for yet higher rates of wages is again raised; so the cost of commodities ever rises higher; so discontent is confirmed in the hearts of employees and employer. Thus the mischief revolves in a vicious circle, ever returning to the same point.

The "Times" correspondent mentions overtime as being "tabooed by the various unions." There it is possible to agree with them. Systematic overtime on a home job is an outrage. Where men work away from home, as in the construction of works or the installation of plant, it is a good thing—keeping them out of mischief. Otherwise, except for emergencies, I for one am strongly in favour of reasonable working time, whereby the man may have leisure, without over-weariness, to cultivate his mind and perfect his citizenship. What the working man (to use a very question-begging classification) chiefly needs is a keener, deeper sense of responsibility for himself and his belongings. He should feel independent of patronage and traditional benevolences, which can never be so long as he has not something, however small, over at the week-end. Regret has often been expressed at the indifference and ingratitude of men and women of this class towards good employers. Perhaps if we were better students of human nature, and, especially, more expert in the difficult art of seeing ourselves in others, we should rather watch the signs of insubordination, and try to ascertain where the burden galls, so that men so readily throw it down.

Some explain the lack of interest on the part of workmen in the fruit of their labour by the subdivision of modern manufacturing methods, and the development of machine tools, by which a man never makes a complete thing, but only a part of a thing, and most often merely has to watch a machine doing that. It appears to me that this explanation does not go very far, because the greater part of the world's work that has to be done has never been skilled craftsmanship. Others argue that the missing sense would be supplied if all hand-workers were more "educated." It depends upon the education.

It has, I fear, been ignored by our statesmen that education can and should be physical and social as well as being intellectual. Far and away the greater portion of the necessary work of the world is that which demands physical address, bodily strength, manual dexterity, quick perception in practical matters—all of which may be brilliantly shown by men who can hardly read or write, and for none of which is a purely intellectual education a necessary or even a fit preparation. It is useless to blink these facts, or to make believe that all the school-teaching in the world will suffice to make a good gasholder erector, a first-rate retort-setter, or a competent gas-fitter. Do not let us deceive ourselves. There is plenty of unclerical work to be done with human hands and brains, and it will command more money than cheap scholastic attainments. It is not necessary to despise the one for the sake of the other order of human accomplishment; they will find their level in the great scheme of things. Even in the United States, where schooling is more eagerly sought after than anywhere else, a stout fellow can sometimes earn more at piling pig iron than a University degree will command.

Educate our working classes by all means, but not in

only one way. The true reason for the failure of our elementary education system, which costs such enormous sums, is to be found in its lack of correspondence with the social environment in which it functions. It is the same with much so-called technical instruction. Teach and train mechanics in all trades; but do not forget that good workmen and citizens cannot be made by technical knowledge alone. They also want to undergo discipline such as that of voluntary national service, to read good books, to play manly games, to learn the practice of local self-government, to have their eyes opened to art and their souls to music. I am glad to find myself in agreement here with a Labour member, Mr. J. R. Clynes, who recently in a newspaper article recommended workmen to "give to good book-reading during the coming years all the precious time they waste on staring at the flashy head-lines and absorbing the worthless parade of the newspaper rubbish which makes up much of the news of the day." Development of character by firmer discipline from childhood to manhood and womanhood is, in my opinion, one of the urgent needs of to-day in all classes of society.

Meanwhile, I hold that a beginning can be made in the creation, in working men of all kinds, of a real interest in the success of their employments, such as they have never hitherto had unless they worked on their own account. This is the industrial position as it has been handed down to us: If a man sets up in business for himself, he takes and stands to everything, profit and loss. If he works just as hard and devotedly for another, he is supposed to be paid by his wage, and there an end. The rupture of the bond of interest in the results is so absolute, while the unity of the moral obligation is so insisted upon, that the condition thus reviewed appears ludicrously inconsistent. Is it right to regard the wage as an ascertained and liquidated compensation for the service rendered? Such a position might have been taken up fifty years ago, and defended with all the force of what has come to be recognized as Manchester economics; but its symmetry has been destroyed of late years by otherwise inspired legislation. I fully recognize that a great breach has been effected in all familiar industrial contentions of the kind by the Workmen's Compensation and the Insurance Acts. It is too soon to value the economic bearings of the latter statute; but it certainly demolishes the proposition that the employers' responsibility ends with the payment of wages.

I consider that this is not all, and that an enormous advance can be made towards the solution of the industrial problem by giving the workers an interest in the fruit of their labours, whether of head or hand, by the way of co-partnership. This is not properly an essay on the system so named; and I must not detain you while I expound my views upon its advantages. I have given the best pledge of my sincerity in this regard, by my administrative policy in the cases of gas undertakings with which I am connected. I am glad to know that my faith in the principle (for the application of which to gas companies we have again to thank Sir George Livesey) is also held by so many other directors of gas companies that at the end of last year the "Co-Partnership Journal" could publish a list of thirty-five undertakings, employing £49,190,980 of capital, as having adopted co-partnership systems. There is one municipal undertaking known to me, Stafford, which has adopted the principle—I presume under the prompting of our esteemed colleague, Mr. J. Ferguson Bell—and I do not see why there should not be more. We must, however, be patient. The leaven is bound to work, if it is good.

We must not expect everybody to see eye-to-eye with us co-partners, and especially is it imperative to allow time for the principle to show its full results in respect of those who are admitted to its operation. There must, of course, be selection. The ancient proverb about "silk purses" and "sows' ears" is warranty for that; since an unsatisfactory workman cannot be expected to make a good co-partner. After that, there will be some who will fail to realize the true purpose of the plan, but will treat the bonus as so much extra wages. This improvidence is contrary to the intention of any scheme of the kind, and must be repressed. Another matter for Time to cure is the opposition of socialists and trade unionists of a certain type, whose position is sometimes actively obstructive when they happen to have influence with elective bodies. I have hopes that even these opponents will come round, if we are careful to approach them by the points where we are agreed. Perhaps these will be found more numerous than either side suspects.

Concerning Coal.

There is one question which is occupying a large place in the thoughts of all of us at this time—namely, that of our coal supply. The past two years have registered considerable advances in the price of the prime requisite of our own and also of almost every other manufacturing industry in the country, and throughout the world. With the exception of America, the manufacturers of the greater part of the nations of the earth appear to be dependent in an increasing degree upon English coal. This is bad for the native industries which, like that of gas, require so much of it as their raw material. Of course, there are two sides to this question; and we must admit that what is a hardship for buyers may be a boon to sellers. A recent trade report remarks exultingly that:

> There are few industries in this country in which prosperity at the moment is greater than it is in the coal-mining industry, or any in which the prospects over the year are brighter. Wages have been advancing at a more rapid pace than they have done at any period since the great boom of 1900-01; employment was never more regular or more plentiful; the profits earned by colliery companies are exceedingly good; and the foreign demand for export coal is so great that coal exporters and colliery owners are clamouring for greater dock accommodation and quicker despatch.

This is all very well for a self-regarding view; although in respect of contemporary labour restlessness, it is perhaps a little too rosy. Some may feel a tinge of regret that all this exploitation of a national asset should be for the profit of one particular interest, which does not pretend to care how the State or the community fares in consequence.

There is no disposition on our part to grudge an adequate return to coal owners and miners. We do, however, object to such increases as we are now burdened with—increases which are out of all proportion to the advance in cost of coal-getting. Scheme and strive as we may to cheapen gas and improve our service to the public, the whole of our efforts may be brought to naught by either the agreement or the falling-out of the coal owners and miners. For the peculiarity of the coal situation is that, whichever side wins or loses by the internal squabbling or concord over the division of the profits, the consumer pays. There is no getting away from the fact that dear coal spells higher dividends and wages in the trade, for which everybody else has to suffer.

This condition of affairs invites unfair play, or at least an excess of selfishness which is hardly distinguishable from it. One cannot resist the suspicion that, if desired, a high price of coal might be maintained indefinitely, by so adjusting the quantity exported that what was left for home consumption would be insufficient to satisfy the demand; when, of course, the expected would happen. The increase of the cost of production in this country during the past five or six years—large as it has been—is, I believe, less than the same increase in Germany, our only possible serious rival in coal production in Europe. Belgian and French coal-mining costs have similarly risen; and American coal, although cheap on the spot, is dear to send over here. All this amounts to what is called a perfectly natural advantage for the British coal-owner; but it is hard upon the home consumer. We may indulge the pious hope that the masters of the situation will not prove too grasping. But I cannot see any real redress forthcoming unless and until something is done, somehow, to separate the legitimate demands of capital and labour in the coal industry from dearness of the article. The problem is difficult; but I am loth to believe it insoluble.

The Institution.

As regards the progress of the members of our own Institution, the best evidence of the fact as well as of its quality is supplied by the substance of this year's report of the Council, with its record of varied work accomplished and in hand, which can be compared with the earlier reports—say, that relating to my former year of office in the chair, 1878.

There is one entry in the report which I sincerely regret, and would have done much to prevent. I allude to the statement respecting the failure of the project for the establishment of the Institution in a house of its own, where its work might be carried on under better conditions. I however, quite agree with the decision of the Joint Committee; feeling assured that so long as the resources of the Institu-

tion are restricted by its actual constitution, nothing of the kind can be hopefully attempted.

A Glance at the Future.

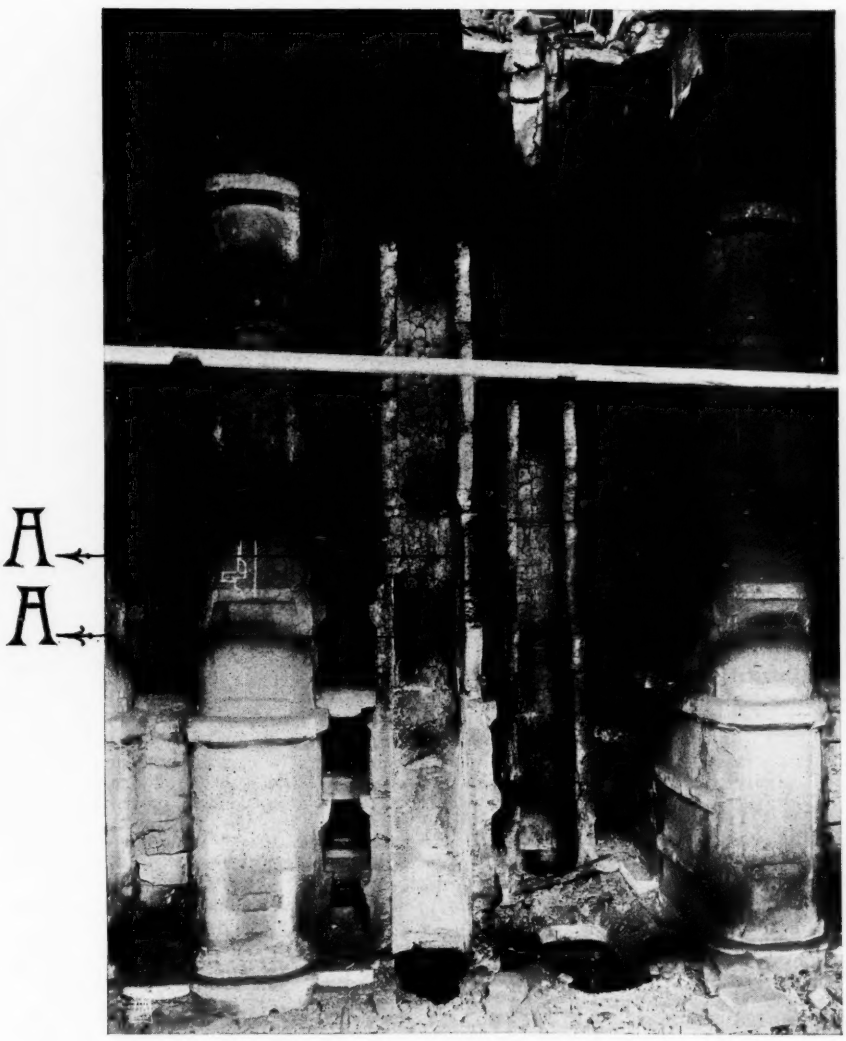
And now—what of the future of our industry? It has been at the back of all my reflections; for, as Thomas Carlyle has said, "We go forth to meet our Future; and lo! it comes streaming-up from behind over our heads." Truer words have never been spoken; for where there is continuity of life, past and future are united rather than severed by the fleeting moment of present time. We are what we are, because of what we have been. Yet the actual moment, while it slips away from our grasp, is all-important, because it is our opportunity for action. It is our duty to work for the future, in the light of the past; and time will prove whether we have done well or ill. There is no falser saying than the pessimistic cry, "It will be all one a hundred years hence!" We are here to-day because of the good work of the pioneers of a century ago.

I believe that, whatever the future may hold hidden from us, this industry of gas manufacture and supply will keep to the sound lines we know. It will grow; but is not very likely to change its principles. We know how solidly it is based upon the bedrock of true economy of the raw material; and we mean to improve every opportunity for economizing capital and labour also. To cheapen gas, and serve the public well, is our ruling policy, to which we shall adhere. While we stick to this rule, and cultivate our business in a spirit of enterprise and frugality, all the consequential benefits talked about by the prophets of hygiene and simplified social service will follow naturally. We shall not dream about "bulk" systems of providing British towns with smokeless, labourless fuel, but do it—making more gas every year; putting out more coal fires; and being more and more generally useful to the community at large. There is little risk of the money sunk in our undertakings becoming unremunerative within any stretch of futurity we need take heed for, because it is barely conceivable that our services can be superseded.

Finishing this discursive address, I can say that we keep the Jubilee of our Institution under conditions which furnish cause for some pride and much thankfulness; and, in the light of our experience the younger men among us may look forward to the Centenary with hope and confidence.

DURABILITY OF VERTICAL RETORTS.

By Edward Körting, of Berlin.



It was soon quite clear to the pioneers of the vertical furnace that even relatively small deformations in the shape of the retorts would cause considerable difficulty in the automatic discharge of the coke. From the very commencement, therefore, one of the chief causes of anxiety was whether the material would stand the high temperature, and the retorts reach a fair age. An experienced practical man like Herr Aug. Klönne, from exhaustive theoretical speculations, categorically denied this, and prophesied for the retorts a speedy and inglorious end. On the other hand, the constructors of the vertical furnaces said that for them the question was how the overheating of parts of the retorts could be avoided; and they experimented for a long time to find out how this could be successfully carried out. It was found that three things were required:—

(1) An efficient and reliable supervision of the furnaces. There is often some considerable difficulty in obtaining this; but we have found everything to go well, as soon as sufficient interest is taken, and the necessary goodwill exists.

(2) The possibility of controlling the furnace at all important

and vital parts. This was only a question of time and experience.

(3) The regulating of the combustion, the formation of the flame, and the proper guidance of the heating gases, in order to obtain for each zone the most suitable and at the same time constant furnace temperature. This was a novel and difficult task, but was completely solved at last.

The results are now to be seen at Mariendorf, where the oldest vertical furnaces have attained the age of 2000 days in action; and the question arose as to whether it was safe to allow these "veterans" to stand the exertion of another winter. Was there not a probability of the walls of the retorts having worn as thin as paper? To answer this question, the front wall was removed from one of the furnaces; and two of the retorts—one in the front row and one in the back—were cut in half, from top to bottom. As can be seen from the photograph, the retorts are still in excellent condition, and can be kept in action for another year, without the slightest hesitation, even if it should be found necessary, after scurfing, to sometimes assist the coke in sliding out. It is not noticeable that the retorts have at all changed their form on the outside; and the slight deformations in the interior are of no importance. The walls of the retorts have retained their full thickness; and the material in the lower halves has become hard from sintering, while the upper portions have remained soft. There were naturally a few cracks; but patched holes—a daily sight with horizontals and inclines—were conspicuous by their absence.

It interested us to find that the only really noticeable deformations occurred exactly in those places which had from the beginning appeared to us to be too hot, and which we had only learnt later on how to regulate to a proper temperature—see A A in the photograph.

ELECTRICITY SUPPLY MEMORANDA.

THE evidence grows that among electrical engineers there is serious discontent with the structural arrangements of the electric cooking appliances on the market. It would not have become so serious if the users of such electric-cookers took quietly the playful antics of electrical devices of the kind, which "let them down" at most inconvenient times, and display confirmed dilatory habits to which housewives and cooks have been hitherto unaccustomed. We have several times called attention to the complaints of electrical engineers on these points. Only last week it was mentioned that the Incorporated Municipal Electrical Association were going to secretly discuss the subject of electric cooking at their conference next week. It does not look well this talking behind closed doors. It suggests that there is something that is very much in existence that it is better should not be brought to the eyes and ears of the public. It is bad enough when it leaks out through the ordinary courses of personal experience, and becomes local gossip. Recently, too, it was remarked that the "Point Fives" were going to discuss the standardization of electric-cookers, which again was evidence of discontent. When reference was made to the matter in this column, it was suggested that standardization at this early stage was not a good thing for individual effort and the general development of the cooker. The "Point Fives" have had their discussion; and their conclusions have been published. They avow that they in no way wish to hamper the development of electric cooking apparatus by attempting, at this early stage, to standardize details. All they desire to do is to place before manufacturers a number of general preliminary principles, which, as a result of the use of various types of cooking apparatus, they consider to be of importance. The recommendations point unerringly to defects, and to extra cost in construction. But reliability is imperative above all things; and it cannot yet be claimed by electric cooking appliances.

Defects and Bad Habits.

The Recommendations.

The first recommendation is that domestic and other cooking ranges—consisting of oven, grill, and hot-plates—should have each sub-circuit separately fused, and each protected by a switch. The oven, too, should have two or more circuits. The separate fuse and switch can easily be arranged for; but it means adding (say) £2 or so to the cost. Notwithstanding, the poor manufacturers are already being tormented by some electrical enthusiasts for cheaper and cheaper appliances. The enthusiasts who know more about electricity generation than the construction of electrical appliances, overlook the fact that there is a profitable limit to production, that there are market prices for material and for skilled labour, and that there are Employers' Liability, Compensation, and National Insurance Acts. The second recommendation of the Point Fives is that switches and fuses should be placed in such a position that they cannot become unduly heated, that they cannot be damaged by liquids being spilt over them, and so that they are easily accessible. There are seen the further seats of trouble, which it is desired to remove; and it is again a struggle for supremacy between cheapness and reliability. Then it is proposed that provision should be made for efficiently and thoroughly earthing all apparatus. There has been trouble in kitchens through the absence of any proper earthing. Proceeding, it is proposed that cooking ranges should be fitted with at least one indicating device (separately fused) which will clearly show whether any circuit is turned on. In some quarters, it is not considered that this proposal goes far enough. It is urged that what is wanted is an indicating lamp in series with every heating element, as this would not only show that a local switch was closed, but that the element was intact—which, we agree, would be an important advantage to the user. At the same time, in the middle of the cooking of a dinner, without some stand-by method of cooking, it would be but poor comfort to the user to have ocular demonstration that an element was not intact. The fifth and final recommendation is that manufacturers and designers should endeavour to develop a hot-plate which will work satisfactorily at a red heat. There, again, life and expense are factors that will weigh with the manufacturers. Some manufacturers are now reticent about giving substantial guarantees; and they will be still more so if the temperatures of the hot-plates are to be raised to red heat.

Thank Goodness for the Simple Gas-Cooker.

A frank letter has been written to the "Electrical Times," by Mr. R. A. Lower, Sales Superintendent of the Norwich Corporation Electricity Department, on the general subject of electric-cookers. He says outright that his experience and investigation have resulted in the conclusion that the three qualities of reliability, efficiency, and cheapness are difficult to realize in one piece of electric-cooking apparatus. Reliability is more or less sacrificed when efficiency is high, and *vice versâ*. Reliability should, of course, have preference. Mr. Lower makes another point. The desirability of residual heat in electric-cookers is constantly spoken of. This "residual heat" makes quick response to the switches impossible; and he holds that this is a trouble (therefore it cannot be an advantage) that makes cooking much more difficult. The responsibility is imposed on the cook of having to calculate forward exactly when to switch-off, so that the cooking operations may be completed (no more and no less) by the heat stored in the oven or hot-plate. He also comments on the considerable amount of waste that goes on in the oven—with, we take it, the definite uses of current when only something small is required in the way of cooking in the oven. An oven that possesses marked residual heat properties is of necessity slow in attaining the cooking temperature—a characteristic of which most cooks strongly disapprove. Mr. Lower fully agrees with the idea of a separate switchboard on the wall in front of the "engine-driver;" and he contends, as many others do, that a separate indicating lamp for each circuit is indispensable. With electric-cookers where there is nothing to show they are "on" or "off," it is the easiest thing possible to leave a hot-plate or perhaps an oven switch on for hours. If this happens at all frequently, electric cooking will have its expensive side considerably emphasized. One other point that should be carefully watched. Some makers omit to supply a fuse in the lamp circuit. The omission has caused failures which are likely to be serious if a heavy fuse is on the mains. Thank goodness the gas-cooker is not extinct! It promises, with its economy, its fine range of heating, its reliability, and its cheapness in first-cost and installation, to remain the most popular cooker in the world.

Doubt or Expediency.

In the "Memoranda" last week, a few comments were made on an article bearing the title of "Didymus" that had appeared in the Commercial Supplement of the "Electrician." The writer, it will be remembered, scoffed at the doubting Thomases of the electrical profession, who do not think that there is much in the domestic electrification proposition, and who do not dig deeply into their incomes to practise in their home life what they preach in their official life. Circumstances, as the tenour of our comments showed, alter cases in this as in other matters. A harassed central station engineer writes in much the same strain in replying to our contemporary. He is situated in a locality where lighting must of necessity form the backbone of his business. The undertaking has suffered considerable loss of revenue by the adoption of metallic filament lamps. He considers that, under the circumstances, he is better engaged in devoting his energies to securing lighting connections at 4d. per unit than in working to secure custom for other purposes at 0·5d. per unit. He is sanguine enough to believe that there is a vast lighting area to be tapped; and this must be secured before any great headway can be made by low cooking rates. He considers that in this matter it is the assistance of the lamp manufacturer, and not of the cooking apparatus maker, that is required. The difficulty of the lamp manufacturer is that his productions cost money, and he is entitled to a profit; and already, owing to the cutting-down of prices, fault is being found with erratic performances in regard to candle power and consumption at the rated voltage. What can be expected if he is to make these delicate lamps (the efficiency of which depend upon their structural accuracy) at cut prices? However, the central station engineer critic reminds of the fact that the price of the lamp represents over 25 per cent. of the cost of a point in cottage wiring. Further, in the case of idle services, when a house is re-let, the fact that it costs nearly £2 to equip twelve points with lamps, as against 3s. with gas mantles, puts a severe handicap on electricity. These are the findings of his practical experience. He holds that the income from a cooking load can only be profitable when it is supplementary to, and not instead

of, the higher-priced unit. In the concluding part of his letter, he suggests that there is a waste of space in the present electrified gas-cooker that must be overcome. This is a common view in electrical circles; and there is advocacy of false tops or bottoms for ovens, so that the space of the oven to be heated should have some relation to the work the oven is for the time being called upon to do. But while the space is alterable by such means, the heats must be full-on, three-quarters-on, half-on, or a quarter-on. They are fixtures.

Misinformed.

If the articles in the "Standard" headed "Electricity in the Home" are to be of instructive value, they should be correct in their statements. The writer of the articles has been dealing with the subject of ventilation; and a pretty mess he has made of the point treating of the presence of carbon dioxide in the atmosphere. He is in this matter a long way in rear of the times. He states that air containing but four parts of carbon dioxide in 10,000 is air of standard purity, and that the limit of impurity is generally placed by medical authorities at 10 parts in 10,000. Those medical authorities are only to be found among the ancients; for no medical authority of to-day who knows anything about the subject would be so foolish as to place the limit of carbon dioxide at 10 parts in 10,000. The writer goes on to say that 14 parts per 10,000 is "a proportion that is decidedly harmful." A further silly statement is that "although carbon dioxide is a poisonous gas—a non-supporter alike of air [whatever that may mean] and combustion—the discomfort caused by its presence in a badly ventilated office is not due so much to the actual poisoning effects as to the efforts of the heart and lungs to resist the absorption of the carbon dioxide." This nonsense after all that has been published on the subject! One after the other authorities have told us that 100 parts of carbon dioxide in 10,000 parts are not harmful to human beings, and further that there is no injurious effect even when the proportion is as high as 2 and 3 per cent. The writer in the "Standard" should tell us how it is that men in breweries work in twelve-hour shifts in atmospheres containing 0·5 to 1·5 per cent. of carbon dioxide; and men in aërated water factories in atmospheres containing as much as 3 per cent. He should also consider, in connection with his own absurd statements about the heart and lungs, what Dr. Leonard Hill, of the London Hospital, meant when he recently told us that, whatever the percentage of carbon dioxide in the atmosphere might be, that in the pulmonary air is kept constant at about 5 per cent. of an atmosphere by the action of the respiratory organs. The writer in the "Standard" had better look to modern sources of information on this subject, and then write upon it again; so that his at present misinformed readers may be correctly informed. Perhaps his research will be lightened by reading the "Hygienic Aspects" chapter in "Competition Points for Gas Salesmen."

An Informative Report.

Later on, we shall be generally noticing some of the features of the annual reports of municipal electricity supply authorities. But there are a few points in the report from Croydon that are very instructive. It is almost unnecessary to tell our readers, as we have previously had occasion to refer to the fact, that the Electrical Engineer of Croydon is Mr. Alex. C. Cramb. Well Mr. Cramb reports that last year there was an increase in the business of the undertaking of 242,516 units, of which 56,558 units were for heating and cooking. There seems some strange reticence about separating the power, heating, and cooking sales in connection with electricity undertakings. Evidently, however, the cooking load has not yet assumed any great importance in Croydon, as Mr. Cramb remarks that a material increase from cooking must not be expected until the Corporation take in hand the hiring-out of cookers at reasonable rates. He omits to point out that there must also be kept a gentlemanly staff of expert inspectors to make something like weekly visits to the houses of users to see that the apparatus is in order, and does not betray any symptoms of occasioning early trouble. However, though there was the increase mentioned in consumption, the total expenditure on revenue account showed an increase of £5074, while the total receipts only advanced by £4107. It seems that the coal bill is partly accountable for this; contract prices having risen from 11s. 11d. per ton in 1909-10, to 18s. 3d. for certain contracts in 1912. Practically all material has risen 10 to 20 per cent. In view of this, it might be well if the Corporation looked into the question of whether the low-priced units are now paying for themselves. There is another interesting point. The funds of the concern are being laid under heavy tribute now in order to meet capital expenditure. At the end of the year the reserve fund, with interest, amounted to £40,076. But £8026 has since been withdrawn for new plant; and there are outstanding liabilities chargeable against the fund totalling to £7693. These two items make £15,719; and, deducting them from the £40,076, leaves the reserve at only £24,357. Then the auditors point out that £6466 has been debited to revenue account which might have been regarded as capital. It is clear that the present consumers are being heavily taxed in order to save a proportion of capital charges in the future. The £15,719 and the £6466 together make £22,185, which is a considerable sum to draw in such a short time from money provided by the business. Yet, in addition, the customers of the concern have to supply the money for ordinary capital charges, and something is appropriated for the rates. These proceedings are not financially sound.

Canberra.

A short time ago, one of the electrical papers jumped to the conclusion that Canberra, the proposed Federal Capital of Australia, was to be an "all-electric" city; and some inane (an "s" can be inserted or otherwise according to the views of individual readers) remarks were made as to gas-works in the neighbourhood of the new capital being a "pollution." In a private letter recently received from a personal friend—to wit ["to wit" is a favourite expression in gas circles just now] Mr. P. C. Holmes Hunt, M.Inst.C.E., F.I.C., the Engineer of the Metropolitan Gas Company of Melbourne—there is this incidental observation: "If you are not already aware of it, you will be interested to know that a gas-works is provided for in the Canberra scheme, and a considerable site is set apart for it in the approved plans." In view of this, what has our electrical friend to say in justification of his assumption?

Melancholy Reading—for Electricians.

Turning over the pages of the "Electrical Review" for June 6, we were struck by information contained on three or four consecutive ones. On one page appears a report of an extraordinary general meeting of Crompton and Co., Limited, held to consider a scheme of reconstruction. Overleaf it is learned that the Urban Electric Supply Company are only paying a dividend of 3 per cent. on their preference shares; but there does not seem to be anything in the coffers for the ordinary shareholders. Reading on to the next page, it also appears that there has been a reduction of capital in the case of this Company; and, at the end of the report, the Chairman begged of the shareholders to stick to their holdings, and not to throw them away at the present low prices, for he feels certain that, by holding on, the position would improve for all classes of proprietors. Turning the page, there is a report of an adjourned general meeting of Metalite, Limited. The first lines in the speech made by the Chairman conveys the intelligence that a Receiver has been appointed, and that the Directors have made arrangements under which no sale will take place up to the end of August, in order to enable them to frame a scheme of reconstruction.

NOTES FROM WESTMINSTER.

THE gas and water events of the past week in the Committee rooms were neither large in number nor important in their matter. Such as they are, mention is made of them in the following paragraphs. The measures are going forward in considerable batches now; and there is obviously little intention on the part of Private Bills to interfere with the wish of the Premier to release members of Parliament in August.

Calorific Power.

The Morley Corporation Bill has passed a Lords Committee. The interesting feature about it is that the Corporation are taking the opportunity of setting-up a calorific power standard for gas in place of the illuminating power one. The clauses are on the lines of those of the South Suburban Company, which were passed in 1912. This action of the Morley Corporation should lead other promoters next session to go and do likewise. Parliament has no objection.

By Them.

It is a little strange to find that a representative of the Local Government Board should now appear before the Local Legislation Committee of the House of Commons, and ask that the words "by them" should be inserted after the words "manufacture of gas" in a Bill. This was actually the case in connection with the West Bromwich Corporation Bill; and from the little discussion that took place between the Parliamentary Agent for the Bill (Mr. Cooper) and the representative in question, it would appear that the latter was totally unaware that a Joint Committee sat last year, and determined that, in the matter of residuals dealings, there should be no restriction placed upon gas undertakings. Upon the knowledge in this matter of the Board's representative being brought up-to-date, he gracefully and entirely withdrew his application for the insertion of the objectionable words.

Thirteen Candles.

The West Bromwich Bill passed the Committee, and with the proposed 13-candle standard for illuminating power in it. In connection with this, the matter of the supply by the Corporation of new flat-flame burners to consumers has been made obligatory, on the request of a consumer, by the substitution of the word "shall" for "may;" but in order that the obligation in this respect may be terminable within a reasonable period, three months has been named.

Bournemouth Bill.

As was anticipated, Mr. Herbert Craig's Committee were not greatly troubled by the Bournemouth Gas and Water Company's Bill, which is a measure principally for spreading the

advantages of the Bournemouth Company's management over a larger area, in respect of both gas and water. The Christchurch Gas Company are being taken over by agreement, and so is the Wimborne Water Company. It was only in respect of the latter purchase that there was antagonism; and it came from the District Council, who, as is generally the case in such circumstances, desired to obtain something which the Bournemouth Company could not conscientiously give, and, as a matter of fact, something which, under an agreement with the Bournemouth Corporation, they were not entitled to give—at any rate, for a decade. The Company were proposing to continue the water-rates in Wimborne as at present; but the District Council asked for an equality in this respect with Bournemouth, notwithstanding that the rateable value on which the rates are levied is higher in Bournemouth than in Wimborne. With the lowering of the rates in the latter district to the level of Bournemouth, the Committee were informed that there would be a loss on the supply. The Company, both from motives of fairness and compulsion, in view of their ageeement with the Corporation, resisted the application of the District Council. When the evidence was given, and cross-examination was made, of Mr. William Cash (a Director of the Company) and Mr. Harold W. Woodall, the Engineer and General Manager, the Committee were somewhat impressed with the difference between the amount payable by Bournemouth cottage owners and Wimborne ones—the larger payment being in the latter district. Parliament sometimes rises superior to the best of motives on the part of promoters, and to the most sacred agreements between promoters and local authorities; and, in this instance, the Committee decided that one level of rates should rule throughout the Company's area. Whether there will be the computed loss remains to be seen. Knowing something as to the history of the Bournemouth Company, we expect they will not be long in making up the deficiency by securing new business in the area. There is another point. The Bournemouth Company pump a large supply of water from Wimborne, and are going to pump more. The Company are therefore to some extent the debtors of Wimborne for providing such an abundant supply of wholesome water. One good turn deserves another; but whether to the extent imposed by the Select Committee is quite another matter.

Laying Pipes on Private Property.

It was a curious position that the Barry Railway Company took up before two Committees last week in connection with the development of the gas and water supply of Barry and of certain estates of their own. The Barry District Council have the gas and water supply rights in their own hands, and, among the clauses in the Bill they are promoting this session, is one to confer the very ordinary power to lay gas and water mains in streets not dedicated to public use. The Barry Railway Company have power to supply gas and water on their own property; but they have never supplied gas, and their water is not fit for domestic purposes. The Council in taking over the property of the Company who pioneered the gas and water supplies in the district, also took upon themselves a stipulation that they should not lay pipes on the railway or docks of the Railway Company. Now the Railway Company are developing, for factory and other purposes, land belonging to them. This is within the area of supply of the Council, and cannot be described as part of the railway or docks. The roads, however, will be private ones; and the Railway Company sought to have any estates of the kind that they might develop specified as forbidden ground to the Council. This was going too far; and it was a curious proceeding, inasmuch as the tenants of the factories, warehouses, &c., will require gas and water, and the Council can meet their needs. However, justice was done by the Local Legislation Committee deciding that the Council should have the right to lay their mains in the roads in question. This was also the upshot of a discussion before another Committee, in the case of a Bill promoted by the Railway Company. They sought in this to secure a prohibition against the Council in respect of land they are proposing to acquire and develop. But this second Committee would not hear of it.

Swindling Methods.

Occasionally very apt and pithy descriptions fall from the lips of Counsel in the Committee rooms. The Heathfield and District Water and Gas Company are seeking, and they are encouraged in their action by the Committee before whom their Bill has appeared, to purchase the water undertaking of the Ticehurst and District Water and Gas Company. The Ticehurst Company have not an unblemished history. Mr. C. C. Hutchinson, K.C., was Counsel for the Bill. In referring to the very unsatisfactory state of the undertaking and its supply, he attributed it to the "swindling methods" adopted in the formation of the original concern. Some of the promoting gang are bound to see this paragraph; and it is well they should occasionally be reminded of what others think and say of them, and say in transparent language.

Next week there will be held at the Horticultural Hall, Westminster, a large gathering of experts from all parts of the world to discuss road making. The congress will extend over six days. Among the questions to be discussed is that of tarred roads, and their influence on public health, fish life, and vegetation.

STATION GOVERNOR TROUBLES.

By F. R. Parsons.

The underlying principles of all ordinary station governors might be regarded as being so much alike, irrespective of make, that what would apply to one in reference to a fault should apply with equal directness to another—given the same conditions of working, and the same demands on its services. But in practice this assumption is somewhat negatived by the presence of individual peculiarities, detrimental in character, which in some unaccountable way develop and assert themselves for no obvious or tangible reason whatsoever; and all the remedial skill brought to bear upon the subject fails to elucidate what in many cases for ever remains an impenetrable mystery.

Who, for example, can explain the reason why a governor which has proved to the completest satisfaction its capability to deal with certain conditions in a wholly effective way, and yet if put to fulfil certain similar conditions in another situation or locality is productive of nothing but trouble, is exasperatingly unreliable, and altogether ineffective? And yet many will bear the present writer out that this is so. He could quote chapter and verse in several such instances which have come under his notice, and in which a certain make of governor has been replaced with one of another make for no other reason than that the former had worn out the patience of its possessors. And yet in nearly every case this drastic step had not been determined upon until every known and possible means had been exhausted to prove that its inefficiency was the outcome of structural or mechanical defect.

To carry this contention one step further, it may be stated as an interesting fact that in one case the writer was so fully convinced of the complete mechanical fitness of one particular governor which had been replaced by one of another type that he recommended its instalment in another works where the demands, make, pressures, and conditions of working in respect to the gasholders were almost identically the same as before; and in this instance the governor fulfilled all the conditions required to the most complete satisfaction.

First thoughts would justify one in coming to the conclusion that there is a something which in cases such as this is outside human ability to fathom. But those whose minds are more practically attuned know that for every practical effect there must, of necessity, be a practical cause; and although at the moment it may not be apparent, as far as *primâ facie* evidence is concerned, we know that it does exist, and respect it accordingly as something which has beaten us. Yet, as against this, some of us can as readily recall cases when all our ingenuity, resource, and insistence having failed to successfully locate the seat of trouble, quite by accident we have in our investigations stumbled unwittingly against the origin, and again by a continuation of the laws of accidents (if such a term be permissible) have we in our ignorance set things right. But this, we have to confess, leaves us in a more bewildered, unsatisfied state than ever, and in no sense of the word can be regarded as having taught us anything which is likely to be of benefit to us in the future.

Of the known, visible, and most common causes of failure in a governor, perhaps the two most likely to occur and bring about a continuance of trouble and unreliability are (*a*) where a governor is so much larger in valve-area than is necessary to deal with the maximum consumption, and (*b*) where the movements are constructed so tight-fitting as to induce a dragging, sluggish effect, and so destroy whatever sensitiveness it should have.

Dealing with the first-named trouble. This is often brought about by the desire of the engineer when specifying for a new governor to have one of such a size as will meet contingent growth in consumption, or some known future extensions at perhaps a date some years hence. The consequence is that a governor is supplied which is altogether unsuitable in capacity and valve-area for present consumption, one from which all sensitiveness is a lacking feature, one which will not efficiently control the fluctuations of the inlet pressure, one which cannot be relied upon to maintain a constant pressure on the outlet. The writer has known cases where the provision referred to has been carried to such an extreme, and the governor made of such a size, that the valve movement during the hours of least consumption did not exceed 1-64th of an inch. Even during the heaviest consuming period the valve opening was no more than 5-16ths of an inch diameter. How then is it possible to design a valve which shall efficiently control the flow of gas under all conditions, and maintain against all inlet fluctuations an unvarying outlet pressure within such limitations? And yet the makers of governors are frequently expected to do this, and guarantee efficient working! Under the circumstances, it is quite pardonable if the latter claim that it is possible for their own particular governor to satisfactorily fulfil these conditions. It is only business. Perhaps they can point to one particular case as a complete justification of their claim. But as "one swallow does not make a summer," neither will the writer be persuaded that it would not be better for all concerned if the makers were to point this out to engineers when circumstances permitted, and allow the former to be better judges of the capabilities of their own make of article.

On the other hand, neither can a governor which has an area restricted for the consumption be expected to fulfil its duty in a satisfactory manner. The writer remembers one such case when he was called in to advise upon a governor which had failed to

control the pressures, or even respond to any weight placed upon the bell. No matter what the position of the latter—either full up or quite down—the outlet pressure remained (constant and unalterable) a little below the holder pressure. Upon making an internal examination, it was discovered that the governor was minus a valve. This, it was ascertained later, had been removed at the instigation of the late works' manager in order to permit the governor to pass more gas. And the holder pressure was 4¼ inches on the single lift and 5½ inches when cupped!

One frequently hears it expressed in governor-room parlance that it is a sure sign of a governor's efficient working if it "sings." By this is meant the slight droning hum one can sometimes hear by putting one's ear against the bell. But it is well to remember that it does not at all times necessarily imply efficient and satisfactory working. A governor whose valve is "wire-drawing," owing to restricted passages, will sometimes give out this sound; and it is then apt to lull one into a sense of false security. "Wire-drawing," besides reducing pressure perhaps at a period when the maximum pressure and output are needed, to a very great extent destroys a governor's sensitiveness, and moreover assists in the rapid deposition of any precipitants which may be contained in the gas, and so bring about a grave contributory evil.

The movements of a governor—that is to say, those parts which are naturally in suspension either in gas or liquid, such as the valve, bell, guide-rollers, and guiding attachments—require to be very carefully and accurately aligned, balanced, and adjusted, in order to eliminate all chances of its hanging, either the valve in its seatings, or the rollers in the guides. The importance of this is too often disregarded, with the result that a governor becomes wholly unreliable, and frequently so misleading in its action as to render the adjustment of pressures a matter of the greatest difficulty and anxiety. Some makers of governors fit to their bells, which are water-loaded, a pressure regulating device of a very simple character. This consists of a draw-off tube, within the loading compartment, having connection with a cock and graduated pointer fitted on the outside. Whenever it is desired to set the governor outlet to any given pressure, the pointer is moved to a mark previously ascertained and recorded on the scale; and this in turn actuates the overflow tube within the compartment, and water begins to flow from the latter into the outer bell tank, and so lowers the pressure on the outlet the required amount. If the pressure needs raising, the indicator is moved in the opposite direction, to a set point—thus raising the level of the overflow tube—and water is set running into the loading chamber. When the correct amount necessary to give the increased pressure has entered, it automatically overflows again into the tank.

It will thus be seen that such an arrangement is not only positive in action, but, if everything in connection with the movements is in perfect order, absolutely reliable; and an attendant can so adjust his pressures that it will operate gradually or quickly, within a few minutes or an hour as desired, and then leave it with perfect confidence.

But, as I have already hinted, it is essential—more so in this type of pressure adjuster than in one regulated with dead-weights—that all the movements are absolutely free to respond to the increased or decreased loads put upon it. A little stickiness in a valve or guide-rollers, a little tightness due to the non-alignment of parts, would be more likely to be overcome if dead-weights were added or removed instantaneously. But in a gradual removal or addition, as would be the case by the use of the attachment described, the chances of hanging or sticking would appear to make it much more imperative that freedom of movement be a *sine quâ non*.

Perhaps on this account it will be put forward that a dead-weight governor would be more desirable, not to say reliable, than a water-loaded one, as it would be likely to permit of greater latitude in the way of error. But in practice it is found that in nearly every case with modern governors a decided preference is shown by gas engineers for a water-loaded one. And this is perhaps easy of explanation. It is generally admitted that the less the amount of shock and disturbance sustained by a governor

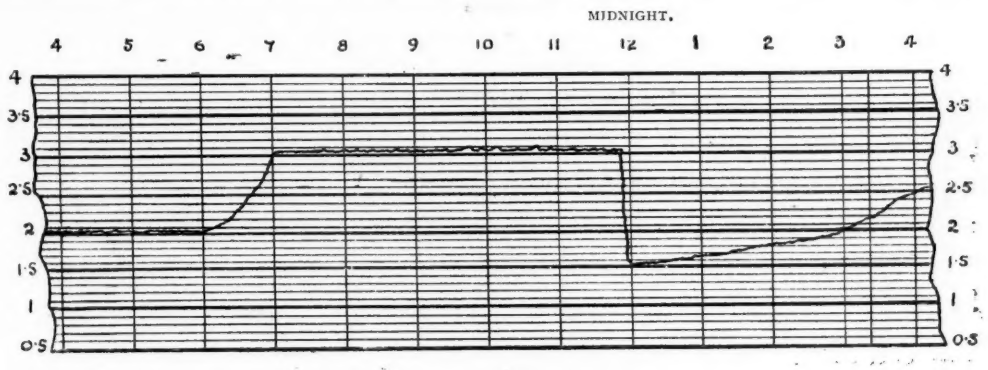


Fig. 1.

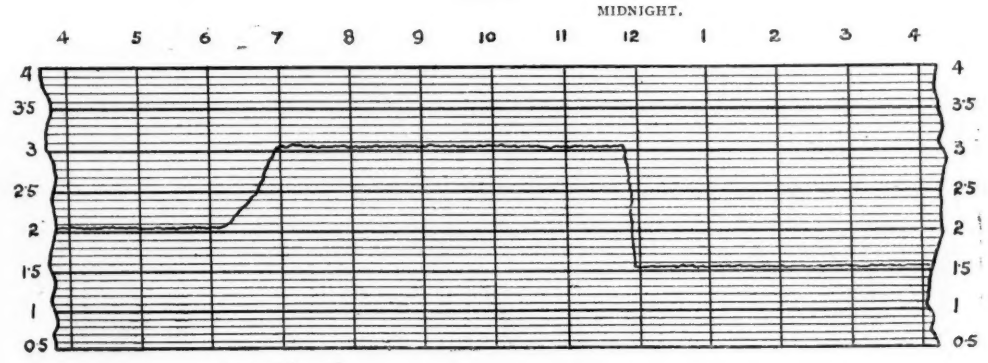


Fig. 2.

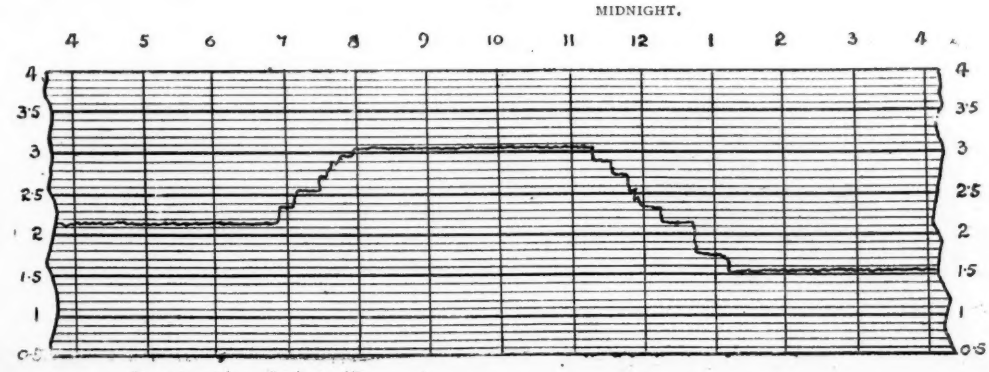


Fig. 3.

during the fulfilment of its duties, the better and more consistent will be the results. It is safe to say that three-fourths of the cases where troubles abound with the ordinary governor—of course, neglecting those induced by what is sometimes known as *anno domini*—arises from a loss of sensitiveness due to the presence of corrosion or other foreign matter around the seats or valves, or else in the guides or rollers. Friction points in a governor need to be studiously and carefully designed and made, in order to eliminate as far as possible the chances of failure which time and corrosion will inevitably create.

To those familar with the readings of the chart as used on automatic pressure recorders—which, it may be explained, permanently record by means of a moving pen or pencil the varying outlet pressures as and when they occur throughout a given period—much information of a valuable and instructive character may be gained respecting the performance of a governor under its varying conditions. Oftentimes a governor which will indicate little or no fluctuation on an ordinary water-gauge, will, if connected to a pressure recorder, and by reason of the latter's delicate construction and sensitiveness of action, show working results which will indicate impending trouble in time to obviate more serious stoppage. It also indicates outlet pressure disturbances which may be due to what might be termed abnormal causes—such as the action of a large gas-engine drawing off the main in the near vicinity.

Fig. 1 is a reproduction of an actual diagram taken from a water-loaded governor which was altogether too large in area for the consumption. It will be seen that from the hour of 3 p.m. until 5 p.m. the pressure remained constant at 20-10ths. At 6 p.m. the pressure was gradually raised to 3 inches. And thence onwards until 11.30 p.m. (its period of maximum consumption), the governor controlled the outlet pressure with a fair amount of satisfaction. At 11.45 p.m. the pressure was reduced to deal with the night consumption—just the street lighting; and the governor was set at 15-10ths. Now mark what occurs. The gradual rising line indicates an excess pressure of one inch over that at which it was set—indicating that the governor had lost control of the consumption at its most critical period. The case in point is the one referred to where the writer previously stated that the valve was not open more than 1-64th of an inch.

Fig. 2 shows a diagram taken off the same governor after it had had a special reducing liner and smaller valve fixed into the large valve-seatings, and so restricted the area of the gas-passages.

Fig. 3 is a reproduction of a diagram taken from a 12-inch governor which had become ineffective and unreliable owing to the formation of corrosion around the valve and seating, in addition to the presence of a deposit of naphthalene. It will be observed that the pressure, instead of acting in a decided manner when it was put on at 6 p.m., took an hour to rise; and then it was by a series of jumps. The same thing occurred at 11 p.m., when the pressure was reduced; it then taking two hours before the governor properly responded to the demands made upon it.

COAL-HANDLING PLANT AT THE ORLEANS GAS-WORKS.

By M. Bourgenot, the Manager of the Orleans Gas Company.

The "Journal des Usines à Gaz" for the 20th ult. contained an illustrated article, reproduced from the "Bulletin Technologique de l'Association des Anciens Élèves des Écoles des Arts et Métiers," with the authority of the author and the Association, descriptive of the plant erected at the Orleans Gas-Works for the transport of the coal. The following is a translation of the principal portions of the article.

Introduction.

In the particular case of the transport of material a short distance from one part of a gas-works to another, the mechanical conveyor has considerable advantages; the two principal being a large increase in the tonnage handled during a given time, and a notable decrease in the amount of labour required. The saving resulting from these advantages rapidly repays the capital invested. It may be pointed out that the employment of overhead conveyors will prevent crowding in works where the spaces reserved for traffic are already cramped. At the Orleans Gas-Works, the scheme to be carried out from this particular point of view was as follows: To take up and break the coke at the quenching-

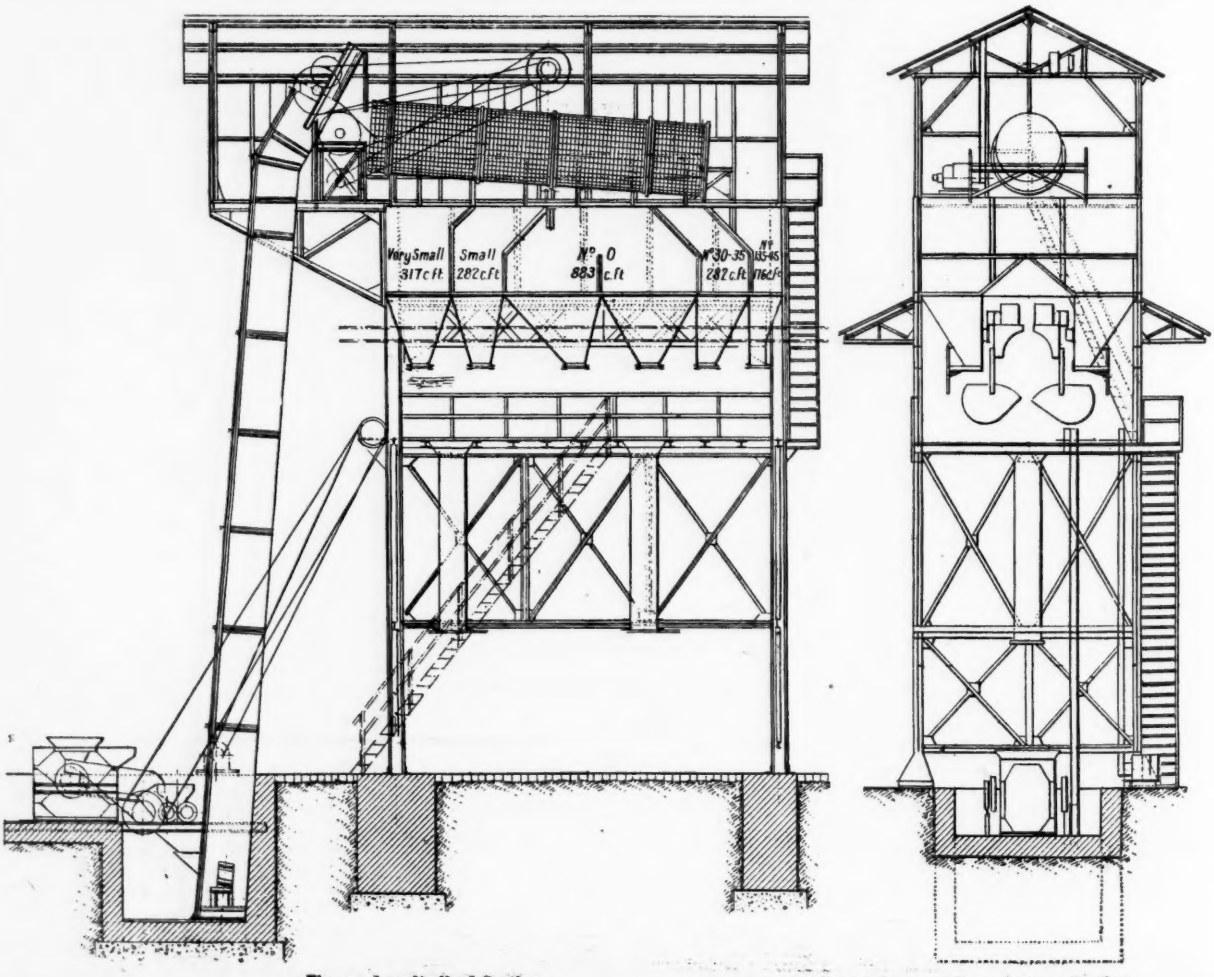


Fig. 1.—Longitudinal Section.

Fig. 2.—Cross Section.

THE COKE SCREENING AND DISTRIBUTING HOUSE AT THE ORLEANS GAS-WORKS.

place without displacement, screen and classify it in merchantable sizes, then carry it away to be automatically discharged on to a spot at a distance of about 500 feet from the coke-breaker.

The question of transport was complicated by the fact of it being necessary to go through the retort-house, and then cross the gasholder yard, without interfering with the large amount of foot and vehicular traffic, and finally avoid the purifier-house and the revivifying-sheds. Consequently, the use of an overhead conveyor was absolutely necessary, and the complete system of plant upon which we decided comprised the following parts: (1) Charging-hopper with two converging conveyors; (2) appliance for preliminary screening; (3) coke-breaker; (4) elevator; (5) rotary screen; (6) coke-bin; (7) fixed overhead line for the continuous running of skips. This plant was to be constructed for a delivery of about 700 bushels per hour.

Details of the Plant.

Charging.—The coke is conveyed by workmen in iron wheelbarrows to a spot below the quenchers, close to two converging conveyors. These are fed, through suitably located traps, with quenched coke, which they carry away to the charging-hopper placed a little above the ground. Each conveyor will deliver the above-named quantity of coke per hour.

Preliminary Screening.—The coke falls from the hopper on to a jigger screen, which also acts as a feed regulator; the space between the bars being so adjusted that the small pieces, less than 1¼ inches in diameter, avoid the breaker, and pass directly to the base of the elevator. The lumps, thus freed from dust and small, fall between the breaker rolls, which consequently do not have to deal with coke which has already been broken, and therefore the percentage of dust can be reduced to a minimum.

Breaking.—The coke-breaker, of the Pinette type, consists of two star steel rolls, running at about 85 revolutions per minute, and mounted on two shafts driven by an enclosed 7 H.P. electric motor, working with continuous current at 440 volts. The same motor is used for the preliminary screen.

Elevator.—This consists of an unbroken series of buckets, made of riveted steel plate, mounted on a chain, formed of bars and cross-pieces, running on four-sided driving wheels. There are stretchers at the base of the chain, and guides along its entire length. The elevator is enclosed in sheet iron and angle-irons, forming a rigid and resisting casing, the chief object of which is to protect the workmen from falling pieces of coke.

Screening.—The broken coke thus raised is emptied into a separating cylindrical screen, 21 feet long and 4 ft. 6 in. diameter, turning at the rate of twelve revolutions per minute, at an inclination of about an inch to the foot. The screen is made of steel plates, perforated to the usual dimensions. The screen and elevator are worked by an electric motor similar to the one already referred to.

Separation of the Coke.

The coke is separated in the following proportions:

Very small and dust, passing	¼-inch screen	. . . .	12·5	p. ct.
Small (*grésillon*),	,, 1 ,,	,, ...	16·8	,,
No. 0,	,, 1½ ,,	,, ...	56·0	,,
No. 1,	,, 2 ,,	,, ...	14·7	,,

Coke-Pit.—The coke, falling from the screen by gravity, is stored in a pit capable of holding about 1500 bushels, divided into several compartments of the following capacities: Very small and dust, 250 bushels; small, 220 bushels; No. 0, 900 bushels; No. 1, 130 bushels. The pit is constructed of sheet steel; the bottoms of the compartments being lined with armoured cement, and furnished at the base with horizontal traps, easy to work by hand with a vertical lever, for discharging the coke. This arrangement makes it possible to fill the skips or carts rapidly in the event of the stoppage of the conveyor. This is done by the aid of two wide vertical pipes, widening out slightly from top to bottom, and provided at the higher part with a funnel which can be brought into communication with the compartments by means of a movable shoot having a considerable slope. The lower part is closed with horizontal traps worked by a lever and connecting-rods. The coke-pit supports the screen, and is constructed in such a manner that the workmen can walk all round the moving parts.

The entire plant is protected by a roof and galvanized corrugated iron panels on the sides. The two floors of the screening and distributing house can be conveniently reached by a staircase and a ladder with double bars, as shown in figs. 1 and 2.

Transport of the Coke.

This is effected by means of a perfectly horizontal overhead line, forming a closed circuit, on which run the skips suspended from an electric tractor. The line deserves special mention, on account of its simplicity and great carrying power. It consists of a flanged rail fixed on the upper wing of a rigid double T-iron girder, 12 inches in diameter. The girder, securely braced, is supported on angle-iron pillars, 33 to 40 feet apart. In order to pass over buildings and obstacles, the line had to be placed at an average height of 30 feet.

The number of skips was fixed so as to obtain a delivery of 10 metric tons of coke per hour; each skip carrying 7¾ cwt. moving at a maximum speed of 4 feet per second along a closed circuit 1120 yards in total length. The body of the skips is formed of a tipping receptacle, fastened during running by two hooking levers. Automatic tipping is effected at any point without stopping the skips. The three skips are suspended from the tractor by a braced frame attached to a heavy side-piece upon which the two rollers and a 2 H.P. enclosed motor are fixed. The running is so smooth that the power required for each motor, during transport under load, does not exceed 250 watts. The flange of one of the two rollers is formed of a toothed wheel driven by a pinion which is itself worked by the motor placed at the side, as shown in fig. 3.

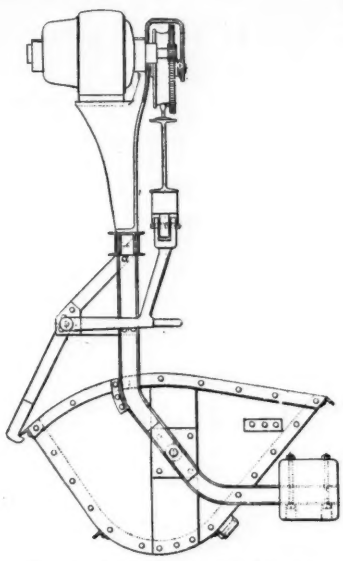


Fig. 3.—The Coke-Transporting Skip.

The workman who fills the skips sets the tractor running by means of a starting-switch. The electric current, at 220 volts, is supplied to the motor by an overhead cable with double parallel wire running above the track from end to end. Each motor is provided with a double trolley—one for the supply, and the other for the return of the current.

As the skips travel without a driver, it is requisite, in order to ensure reliable running on the closed circuit, to employ an automatic protective device to prevent accidents through collisions between two skips. It was therefore decided to adopt the block system. For this purpose the circuit was divided into eight sections fed by one conductor. When a tractor passes from one section to the next, it switches off the current from the hinder section, and this prevents another tractor entering the section until the one in front has passed into another section. Thus the skips are separated by a section without current. Commutation is automatically obtained by rotary regulators, worked in passing by a lateral pointer on the tractor.

The coke having been discharged, the skip returns to the loading-place, enters a section where there is no current, and stops. The workman sets it running again, when necessary, with the switch.

Cost of Working.

Taking into consideration the inevitable loss of time and irregularity in labour for feeding the coke-breaker, the consumption of current for all the work, breaking, screening, and transporting the coke, calculated for a period of ten months, has not exceeded 750 watts per ton. Considering that the total quantity handled did not exceed 40 metric tons per day, it will be seen that the expenditure of energy is not excessive.

The number of workmen required is, of course, variable. The handling of 10 tons of coke per hour is effected with four men for loading and a mechanic for working the motors. The cost of handling, including the supply of energy, amounts, on an average, to 22c. (2·2d.) per metric ton. With the old plant, the total cost, with labour and motive power (crushing, mechanical screening, horse traction, and hand labour), came to 1·45 frs. (1s. 2d.) per ton. Thus there is a saving of nearly 1s. per ton. Leaving out of consideration maintenance expenses, which are the same with both systems, it may be concluded that the saving is such that it is possible to pay off in twenty years, at the rate of 5 per cent., the capital invested in the plant, and also obtain, if not a financial benefit, at least working facilities which can only increase as the works develop.

Ilkeston Gas Management.—We learn from our local correspondent that Mr. F. C. Humphrys has intimated his intention of attending the special meeting of the Ilkeston Town Council which has been demanded, as stated in the "Journal" last week, for the purpose of enabling him to give in public his explanation of the circumstances relating to the erection of the spiral-guided holder which has figured so conspicuously of late in connection with the gas affairs of the borough. In view of the many conflicting statements which have been made during the course of debates upon the matter, the meeting is being looked forward to locally with considerable keenness; while in regard to points affecting municipal administration it promises many elements of general interest.

THE WALTHER FELD PROCESS FOR THE MANUFACTURE OF SULPHATE OF AMMONIA.

A PAPER was read on this subject by Signor A. Pacchioni before the annual general meeting of the Italian Gas and Water Association in September of last year; and it has since been issued as an illustrated *brochure*. We propose to give a full translation of this paper, as no detailed account of the working of the whole process has yet appeared in our columns. We now give the first part of the paper, which concerns the general working of the process, and some details of the plant installed at the Königsberg Gas-Works.

The patents of F. C. Hills, of Deptford, nearly 50 years old (the first is dated April 25, 1868, subsequently completed by the patents of Feb. 21, 1870, March 4, 1874, May 24, 1875) are the bases upon which the greater part of the processes for the purification of gas with ammonia were established. As is known, ammoniacal liquor contains, in solution, ammonium sulphites and carbonates—unstable and easily decomposed compounds. At 82° C. their decomposition is complete. Sulphuretted hydrogen and carbonic acid are, besides, less soluble in water than ammonia. Consequently, when ammoniacal liquor is heated to about 80° C., the main part of the sulphuretted hydrogen and carbonic acid is set free, together with a little ammonia; while the greater part of the latter remains in solution. Hills' process was not successful, owing to the loss of ammonia in preparing the caustic solution, and because he did not specify the temperature at which to work. The process, however, found application in the best known of the mothods for wet purification—that of C. F. Claus, upon which I shall not dwell, as it is now only of historical interest [English Patents Nos. 7580, 7582, 7584, 7585, of 1886.] I will merely observe that, applied on an extensive scale in Belfast, it had to be abandoned, because although 66·5 per cent. of the sulphuretted hydrogen and 44 per cent. of the carbonic acid were extracted, the sales of ammonia were decreased 50 per cent., to say nothing of the fact that 740 days were occupied in repairing the plant to enable work during 475 days! A real failure! Holgate tried to make a variation in this method, by combining it with a sulphate of ammonia plant; but I do not think that the system survived the experimental trials. Studies and researches were not abandoned after these failures; but another line of work was adopted—the initial idea of purification with ammoniacal liquor not being forgotten.

The ever-increasing importance of sulphate of ammonia brought under notice various proposals, made some time ago, for its direct production, without the use of sulphuric acid, which is very expensive, relatively to the value of the raw materials. Considering that in gas-works sulphuretted hydrogen must be removed from the gas before it passes into the street mains, it seemed reasonable to attempt to convert the expensive process of purification with oxide into a source of profit, by combining the sulphur of the gas, under form of sulphur dioxide, directly with the ammonia.

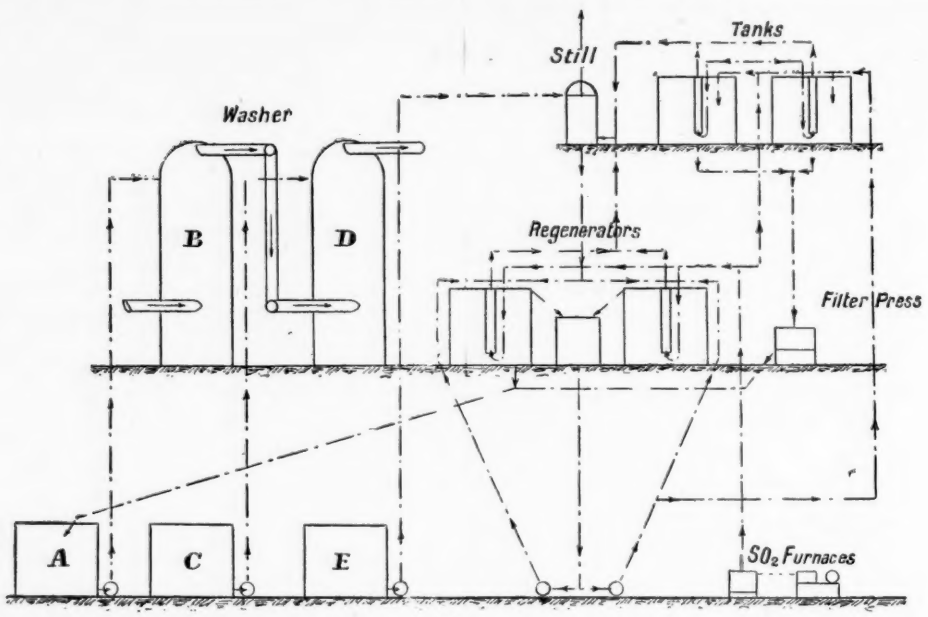


Fig. 1.

In theory this seems easy, but practically there is a difficulty in combining these two gases in a permanent way.

Normal sulphite of ammonia $[(NH_4)_2 - SO_3 - H_2O]$, which has a strong alkaline reaction, gives off ammonia to the air, both in aqueous solution and in crystalline form, and the passing of ammonia to the air increases with temperature. This results in the formation of a very unstable acid salt, $(NH_4) - SO_3 - SO_2$, which gives off SO_2 to the air, being converted only to a slight extent into sulphate. This property of the sulphite makes it impossible to completely absorb the ammonia of the gas with sulphur dioxide, either in aqueous solution or in a mixture with another gas.

It is not certain, as is sometimes asserted, that sulphite of ammonia is preferable to the sulphate for agricultural purposes. Although the neutral sulphite contains somewhat more ammonia than the sulphate, the former also contains water and would have to be dried before use. This drying involves loss of ammonia; and I rather doubt whether a salt which gives off ammonia to the air, and contains free sulphur dioxide, is more profitable than the neutral sulphate.

The transformation of the sulphite into sulphate by simple treatment with air or any other oxidizing agent is problematical, because, according to what precedes, a large percentage of the neutral sulphite is simply transformed into acid sulphate owing to loss of ammonia. Walther Feld, who for years devoted his attention to this important problem, had noted in the course of his experiments that thiosulphate of zinc is decomposed by sulphuretted hydrogen, with formation of zinc sulphide and free sulphur:

$$(1)\quad ZnS_2O_3 + 3H_2S = ZnS + 3H_2O + 4S.$$

In practice he found that, with a single washer and a solution of zinc thiosulphate, he absorbed 90 per cent. of the sulphuretted hydrogen existing in the lighting gas. The zinc sulphide could then be recovered with sulphur dioxide.

$$(2)\quad 2ZnS + 3SO_2 = 2ZnS_2O_3 + S.$$

A complete plant was constructed on this principle in 1909 at the works of the East Hull Gas Company.* The zinc thiosulphate was produced in a preliminary operation. For this object air charged with sulphur dioxide was run through a receptacle containing zinc oxide; sulphite of zinc being then formed:

$$ZnO + SO_2 = ZnSO_3.$$

This sulphite was introduced into a Feld centrifugal washer where the sulphuretted hydrogen of the gas transformed it into sulphide:

$$ZnSO_3 + 3H_2S = ZnS + 3H_2O + 3S.$$

The sulphide was again treated with sulphur dioxide until completely converted into thiosulphate:

$$2ZnS + 3SO_2 = 2ZnS_2O_3 + S.$$

This solution was collected in the tank A (see fig. 1) and thence pumped into the centrifugal washer B, where it came into contact with the crude gas flowing in the opposite direction. The action of sulphuretted hydrogen on the thiosulphate gave zinc sulphide and sulphur:

$$ZnS_2O_3 + 3H_2S = ZnS + 2H_2O + 4S.$$

The liquid flowed from this washer to the tank C, and thence to a second washer D, and finally to a third tank E. The liquid was

* See "JOURNAL," Vol. CVII., p. 816.

pumped out of this last tank into tanks where it was brought into close contact with a current of sulphur dioxide. Then the liquid was conveyed to the regenerators to be finally treated with sulphur dioxide; the noxious gases being dispersed in the atmosphere. The liquid was run through the regenerators until all the zinc sulphide was transformed into thiosulphate, and then taken back to the first tank. When the liquid of the third tank contained about 15 per cent. of sulphur, it was pumped into one of the upper tanks, treated with sulphur dioxide until all the zinc sulphide was transformed into ZnS_2O_3, then filtered in the filter press to separate the sulphur, which was burnt in a special furnace. The liquid then returned to the first tank to repeat the same cycle of operations.

Practical difficulties were, however, not wanting. In the first place the solution of the zinc sulphide in sulphur dioxide was only accomplished with difficulty. Then it was observed that the regenerated zinc solution lost its affinity for sulphuretted hydrogen to such an extent that only 10 to 40 per cent. of the latter could be absorbed, and the lighting gas thus took up sulphur dioxide from the solution. The East Hull plant was consequently abandoned in October, 1910.

On the other hand, even when the action of the sulphuretted hydrogen was very slight, there was a constantly increasing amount of zinc sulphate in the solution, with a corresponding decrease of polythionate. This observation suggested the idea to Feld of applying his system to gas containing ammonia and sulphuretted hydrogen. He found the method very satisfactory as regards decrease of ammonia; at the same time not more than 50 per cent. of the sulphuretted hydrogen could be extracted. As previously stated, the solution of zinc sulphide in sulphur dioxide is very slow; and to avoid this Feld had recourse to iron salts. Iron sulphide is readily soluble in sulphur dioxide; but then another great difficulty arose. Under certain conditions necessary to the process, a part of the iron sulphide was converted into bisulphide (FeS_2), which is insoluble in sulphur dioxide and thus lost for the reactions shown in the following equations:

(3) $FeS_2O_3 + 2NH_3 + H_2S = FeS + (NH_4)_2S_2O_3$.
(4) $2FeS + 3SO_2 = 2FeS_2O_3 + S$.
(5) $FeS_2O_3 + (NH_4)_2S_2O_3 + 3SO_2 = FeS_3O_6 + (NH_4)_2S_4O_6$.
(6) $FeS_3O_6 + (NH_4)_2S_4O_6$ (with heat) $= FeSO_4 + (NH_4)_2SO_4 + 2SO_2 + 3S$.
(7) $FeSO_4 + 2(NH_4)_2SO_4 + 2NH_3 + H_2S = FeS + 3(NH_4)_2SO_4$.

The process consists in washing the gases containing ammonia and sulphuretted hydrogen with a solution of iron thiosulphate. The two gases are absorbed with simultaneous precipitation of iron sulphide, which is reconverted into thiosulphate by treating it with sulphur dioxide. Alternating the action of the gases and that of the sulphur dioxide, the proportion of ammonia salts increases to the extent of being able to work up the alkaline solution for sulphate of ammonia. The thiosulphates are boiled and treated with sulphur dioxide according to equation (5); the polythionate thus produced being then converted into sulphate according to equation (6). A portion of the sulphur dioxide is liberated at the same time, and some sulphur. After being washed, this sulphur can be employed for the production of sulphur dioxide. The alkaline sulphate is again treated with the gas, as in equation (7), with precipitation of iron sulphide and formation of sulphate of ammonia.

This system was tested, on an industrial scale, at Königsberg, but was found in practice to have certain disadvantages. The thionates of the metals employed are easily split-up (especially at high temperatures) into sulphates, sulphur dioxide, and sulphur. This aids the absorption of ammonia, but greatly impedes that of the sulphuretted hydrogen. With lighting gas the inconvenience is less, because it can be dealt with at a relatively low temperature. This is not so with coke-oven gas, which must be treated at about 70° C. in order to produce a sufficiently concentrated solution of sulphate of ammonia, as this gas contains a great amount of water, due to the washing of the coal. Successive experiments were made by Feld with the thionates of ammonia, and thiosulphate of ammonia was found to be particularly suitable, because it is readily converted into polythionate under the action of sulphur dioxide, thus:

(8) $2(NH_4)_2S_2O_3 + 3SO_2 = (NH_4)_2S_4O_6 + (NH_4)_2S_3O_6$

The three final equations, which follow, demonstrate that polythionate of ammonia provides a ready means of extracting ammonia and sulphuretted hydrogen from gas, singly or together.

(9) $(NH_4)_2S_4O_6 + (NH_4)_2S = 2(NH_4)_2S_2O_3 + S$
(10) $(NH_4)_2S_4O_6 + 3H_2S = (NH_4)_2S_2O_3 + 5S + 3H_2O$
(11) $(NH_4)_2S_4O_6 + 2NH_3 + H_2O = (NH_4)_2SO_4 + (NH_4)_2O_3 + S$

In all these three cases the thiosulphate obtained is converted into polythionate according to the equation (8). The final solution is saturated with salts of ammonia, and part of it can be removed from the apparatus and converted into polythionate according to the equation (8), and then into sulphate according to the following equations:

(12) $(NH_4)_2S_4O_6$ (by heating) $= (NH_4)_2SO_4 + SO_2 + 2S$
(13) $3(NH_4)_2S_4O_6 = 3(NH_4)_2SO_4 + 3SO_2 + 6S$
(14) $2(NH_4)_2S_2O_3 + 3SO_2 + S = 2(NH_4)_2S_4O_6$
$(NH_4)_2S_4O_6 + 2(NH_4)_2S_2O_3 = 3(NH_4)_2SO_4 + 5S$

As soon as the amount of polythionate present attained a fixed maximum, the sulphur dioxide set free during the formation o. the sulphate is sufficient to convert the existing thiosulphate into sulphate.

Without doubt this process appears to be the most satisfactory of those hitherto invented. Excepting atmospheric oxygen to produce sulphur dioxide, it does not require another reagent; every element for its application being found in the gas itself. Consequently, were its results such as might be expected from the chemical equations, the cumbersome purifiers, the dangerous and expensive plant for treating ammoniacal liquor, and the heavy cost of the sulphuric acid could all be replaced by a few washers, a small wooden vat, and a few other simple appliances.

The great simplicity of the plant and working should result in a corresponding reduction in expenses. We may now ask ourselves: Has the Feld process, as now simplified, said the last word on the purification of gas from ammonia and sulphuretted hydrogen? This we shall see from an examination of what has been proposed and accomplished by the Königsberg Gas-Works.

The Feld Process of Königsberg.

We shall thus style it, because it is the last link in the long chain of processes invented by Feld for the purification of gas. Experiments were made by Feld at the Königsberg Gas-Works, before the year 1911, with various metallic salts of zinc, iron, manganese, &c. After a few days' work, however, the mud formed by the insoluble salts caused such inconvenience that the experiments had to be stopped and finally abandoned. Since last June, however, enormous progress has been made, as the external reagents have been dispensed with, and the ammonia is recovered exclusively with sulphuretted hydrogen, itself contained in the gas.

When, in June last, I had the good fortune to visit the Königsberg Gas-Works, English coal exclusively was carbonized there, in six settings of four horizontal retorts each, of the Klönne type; producing a total of 40,000 cubic metres [1,413,000 cubic feet] of gas per day. The average heating power of the gas was 18,800 B.Th.U., at 0° C. and a pressure of 760 millimetres. The gas first passed through the air condensers, then the water condensers, extractors, Pelouze purifiers, and the cyanide washers. Thence it returned to the condensers, and entered the Feld centrifugal washer, then a reserve "Standard" ammonia washer, and finally the ordinary purifiers. A diagram of the successive operations is given in fig. 2.

In the first place, the solution of polythionate of ammonia must be obtained. For this the crude gas is treated with water in the centrifugal washer. The sulphide of ammonia existing naturally in the gas dissolves in the water, and, by treating it with sulphur dioxide, the following reactions occur in the apparatus:

$$2(NH_4)_2S + 3SO_2 = 2(NH_4)_2S_2O_3 + S$$
$$2(NH_4)_2S_2O_3 + 3SO_2 + S = 2(NH_4)_2S_4O_6$$

resulting in the formation of polythionate of ammonia. This is the basis of all subsequent working. As will be seen from the drawings, the solution of polythionate is introduced at the higher part of the Feld washer, while the crude gas enters below. When the polythionate is transformed into thiosulphate, the solution is conveyed into the regenerator. This consists of a simple wooden vat, closed on every side, and provided with a central agitator, through which runs a current of sulphur dioxide, produced in a suitable furnace. In the Königsberg vats the sulphur dioxide is introduced at a temperature of 185° Fahr., and a pressure of about 7·87 inches of mercury. The thiosulphate being converted into polythionate, the liquid is conveyed into another tank, also provided with a mechanical agitator, to complete the reaction. From this tank the liquid is pumped back into the Feld washer, and thence again to the regenerator, and so on. When the sulphate of ammonia content of the liquid reaches 35 to 40 per cent., a part of the solution is pumped into the steam boiler, where it is heated for from four to six hours with steam at 212° Fahr. There the polythionate is transformed into sulphate of ammonia, with simultaneous separation of the sulphur. At the end of the reaction, the contents of the boiler are emptied into a centrifuge, which separates and dries the sulphur, while the filtrate is collected and evaporated. The sulphur thus recovered at Königsberg amounted to about 8 cwt. daily.

When the concentration is sufficient and the salt is crystallized, the solution is discharged into another centrifuge, which dries the crystalline sulphate of ammonia. At Königsberg, treatment with steam was applied every six hours, and each time 5 cwt. of sulphur was taken from the centrifuge. The total quantity of liquid flowing through the plant described was about 5000 gallons hourly. As already stated, the whole of the solution in the washer is not run into the boiler; but a certain quantity is allowed to remain, and is diluted with the ammoniacal liquor from the condensers. As this liquor is very dilute, however, it would be better to distil it, adding the ammonia gas to the current of coal gas, so that they pass together into the centrifugal washer. The liquid from the cyanide press filter, on the contrary, which contains sulphate of ammonia in solution, is added directly to that from the Feld washer by means of the vacuum. In practice, a neutralizer, consisting in a vat with an agitator, is added to the plant represented in the diagram. Into this is conveyed the liquid treated in the regenerator, so as to expedite the reaction of the sulphur dioxide, which is naturally slow.

It will not be out of place to give a brief description of the more important parts of the plant used in the Feld process: The centrifugal washer, fig. 3; the regenerator, fig. 4; the sulphur

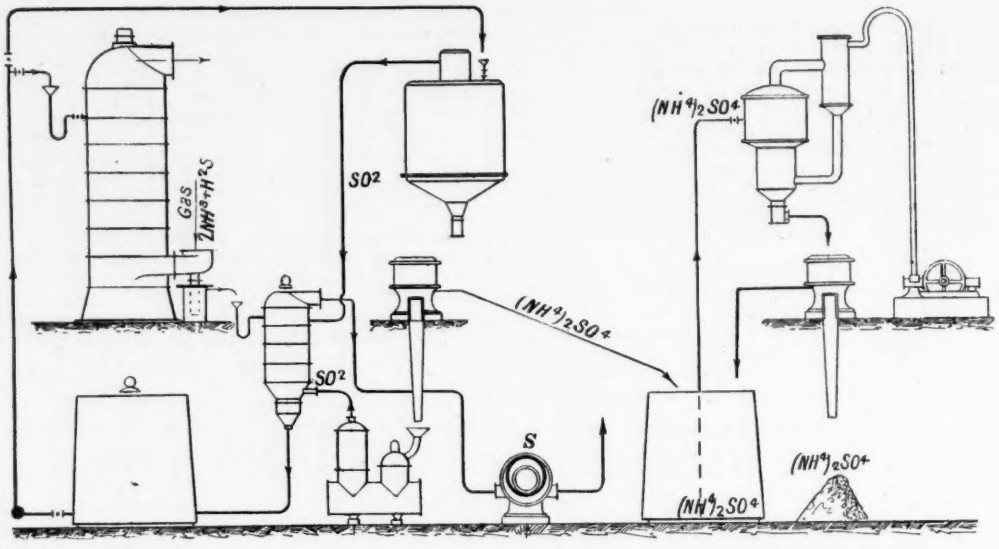


Fig. 2.

dioxide furnace, fig. 5; and the vacuum, fig. 6. The Feld washer, patented in 1905, has now been used for some years with perfect success in gas-works, and is based on a totally different principle to that applied in other washers. Really, the principle in itself is not new, because the centrifugal treatment of gas in the presence of a liquid had already been employed, especially to purify blast-furnace gas. Feld, however, solved the problem in the most effective and practical manner, in my opinion, so that his washer is destined (independently of its employment for the actual process) to replace existing washers, which are slow, cumbersome, and often not effective.

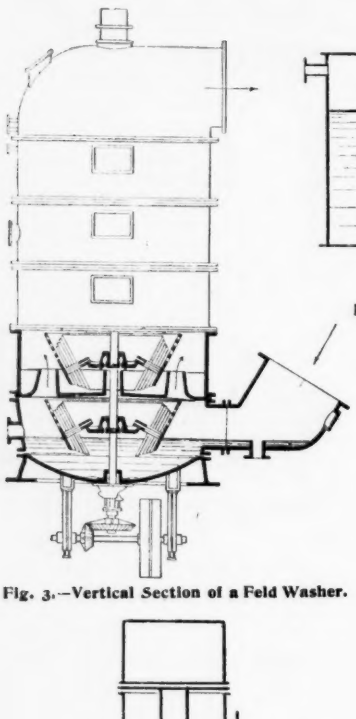


Fig. 3.—Vertical Section of a Feld Washer.

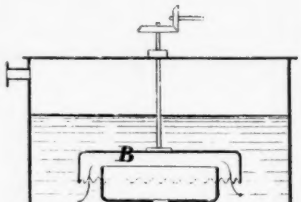


Fig. 4.—The Feld Regenerator.

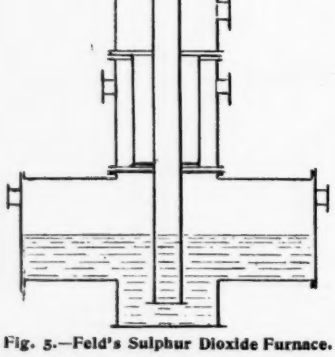


Fig. 5.—Feld's Sulphur Dioxide Furnace.

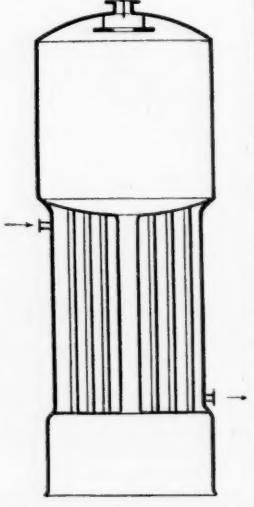


Fig. 6.—The Vacuum for Salt Concentration.

As indicated in fig. 3—a vertical section of a Feld washer—the apparatus consists of a cast-iron receptacle or cylindrical tower divided into a certain number of compartments or chambers, communicating with each other by openings in the partition plates between the chambers. In the centre there is a vertical shaft provided with a cast-iron boss corresponding to each chamber. To this boss are fixed, by a special device, four concentric sheet-iron cones, open on the two bases, the smaller of which is turned downwards. The external cone is a few centimetres in advance of the others; and at its upper part there is a cone, about 7 inches high, perforated with orifices of $\frac{1}{2}$ in. by $\frac{1}{4}$ in. The thickness of the iron plates for the cones is $\frac{1}{2}$ inch, and the distance between them is 1 inch. The central shaft is driven, with double bevel gear, by a motor of any kind to rotate swiftly. The liquid in the compartments is then sucked by the various cones and thrown against the walls of the washer so as to form a curtain of water which completely closes the capacity of the apparatus. The liquid thrown against the wall falls back to the bottom, to be again raised and thrown under the action of centrifugal power. From the semi-circular openings in the dividing bottoms the gas issues, and the excess of liquid descends to be subjected to centrifugal action at each level, and thus brought into close contact with the gas. The apparatus, even if small in diameter, is of very great efficiency. At the time of my visit, a single Feld washer with seven chambers, about 3 ft. 3 in. in diameter, was sufficient to deal with some 40,000 cubic metres of gas in a day.

At Linz I had an opportunity of seeing an experimental washer mounted in an open tank, and this convinced me of the efficacy of washing with such an appliance. From my point of view, however, the best idea is the application of the Feld washer for the purification of blast-furnace gas, which was perfectly successful. The enormous difficulties encountered by engineers, when it is a question of freeing blast-furnace gas from the very fine dust it contains in suspension, are well known. The unctuous and adhesive sublimate which constitutes this dust is in such a physical condition that, even when kept many days in a glass tube $2\frac{1}{2}$ inches in diameter and 39 inches long, it is not precipitated. The introduction of water or the turning of the tube hundreds of times only eliminates negligible quantities of the sublimate. It is therefore necessary to crush the sublimate in the water, so as to bathe it and produce an emulsion, in order to entrain all the dust in the form of mud.

Water under high pressure has to be brought into contact with the gas; and this could be done partly with the Theisen, Thwaite, and Lencauchez washer fans. But of late years the Feld washer has been employed for this purpose, and there is a plant working at the Pompey Iron-Works, at Nancy, to treat over 130 million cubic feet of gas in twenty-four hours. This plant consists of only three washers, about 10 feet diameter and 19 ft. 6 in. high. This fact is the best proof that, even in the gas industry, the Feld centrifugal washer is destined to occupy a prominent position among apparatus for washing and saturation.

Feld gives the name regenerators to apparatus, usually vat-shaped, furnished with special agitators, in which the liquid from the centrifugal washers is brought into close contact with sulphur dioxide produced in a suitable furnace. The arrangement and working of these regenerators are shown in fig. 4, which represents a reversed bell B, with toothed rim, placed over the pipe, through which the sulphur dioxide enters. This pipe terminates with a wider part divided into various compartments, the better to break up the current of sulphur dioxide. The bell can be made to rotate, more or less rapidly, from the exterior. When the bell is shut, the sulphur dioxide which enters through D expands under the bell, and issues through the teeth in the form of large bubbles, which rise vertically through the liquid in the vat. Scarcely, however, has a rotary motion been given to the

bell, when the bubbles begin to decrease, and go round with the liquid, also set in motion by the bell. If the motion is rapid enough, the bubbles vanish, because the gas is divided to such an extent that it forms a regular and consistent emulsion. The action of the sulphur dioxide, nevertheless, is the most effective possible, and it is necessary for this to be so, to accelerate the conversion, which is naturally very slow.

The Feld sulphur dioxide furnace (Patent No. 21,996 of 1911*) is shown in fig. 5. It is also very ingenious. The object is to produce, by combustion of sulphur, sulphur dioxide practically free from sublimated sulphur and without the employment of special condensers or separators. In this furnace, the heat of combustion of the sulphur fumes is utilized for the preliminary heating of the air required for combustion, and also for liquefying the new sulphur which is added gradually.

The vacuum for concentration of the salt is constructed as represented in fig. 6, which is clear enough to make further explanations unnecessary.

(To be continued.)

*An illustrated abstract of this patent specification was given in the "JOURNAL" for June 18 last year, p. 904.

IMPERIAL GAS ASSOCIATION OF JAPAN.

First Annual Meeting.

The number of the "Journal of the Imperial Gas Association of Japan" which has just reached us contains a report of the first ordinary general meeting of the Association, which was held from the 26th to the 28th of April, under the presidency of Dr. T. TAKAMATSU. There were present about a hundred members, representing various gas companies and others connected with the gas industry.

The PRESIDENT, in opening the proceedings on the afternoon of the first day, expressed his pleasure at seeing the large attendance, notwithstanding the members' business engagements. He said the subjects to be discussed had already been before the Council, and had been passed with some minor verbal corrections. They were: The annual report and accounts; the training of engineers, by correspondence in the "Journal," the establishment of night schools, the compilation of text-books, and the appointment of a commissioner in connection therewith; the examination of statistics; and investigations for the purpose of establishing a standard quality for gas.

These subjects were then discussed and unanimously approved of; and the Directors of the Association were authorized to do all that was necessary in regard thereto.

The PRESIDENT then offered a few remarks on the position of the Association. Referring to the publication of their own monthly organ, he said they were doing their utmost to fill it with useful and interesting articles, with the view to promoting the welfare of the gas industry. They had not yet entirely realized their object; and they cordially invited the assistance of the members in making useful suggestions for improving the publication and in supplying written contributions to it. He concluded by thanking all those who had helped to make the meeting a success.

The business proceedings having closed,

Mr. Y. FUJIYAMA, one of the Managers of the Association, read an address on behalf of Viscount K. Kaneko, an honorary member and a Privy Councillor, who was unavoidably prevented from attending the meeting. In the course of it, he referred to the chemical industry as being profitable to the country. In view of the position now occupied by Germany in this matter, he said it was urgently necessary that Japan should further promote the prosperity of the gas industry, which had greatly developed the last few years, and increased the national wealth. It had not, however, attained such a degree of development as that of advanced countries in Europe and America. It was therefore the duty of the Association to place it on a similar level. To this end they should seek, on the one hand, to be a counsellor to the Government, and, on the other, to be a guide to the gas industry in the country.

Mr. H. E. T. YAMAMOLO, in a short address, expressed his great pleasure at seeing that, notwithstanding its recent organization, the Association had already placed itself upon a solid foundation and was developing every day. The fact that until a few years ago the gas industry in Japan was slow in its development, compared with that of Europe and America, was a matter of regret. It had, however, suddenly revived, and attained remarkable results—there being about eighty companies already in operation, and the same number under construction or organization. It might, therefore, reasonably be expected that the time was not far distant when even out-of-the-way villages would enjoy the convenience of gas for both lighting and heating. Nevertheless the gas industry had hardly emerged from the inception stage; and there was still plenty of room for further improvements along the lines of management, manufacture, &c. The duty and responsibility of the Association were consequently great. It was his earnest wish that the officials and members might co-operate in the industry, and so contribute to the national progress and prosperity.

Mr. G. TSUDA, the Engineer of the Department of Agriculture and Commerce, then delivered the following address on

GAS SUPPLY AND MEASUREMENT IN JAPAN.

Although gas has been known from ancient times, yet it is only 110 years ago it began to be utilized as a commodity in England, where the industry was first introduced. Twenty-four or twenty-five years later the gas-meter was invented. With the progress of the gas industry in England, it spread to the European continent and America. In Japan it was introduced first into Yokohama in 1870, and seven years after municipal gas-works were established in Tokyo, and later transferred to the present Tokyo Gas Company. Since its introduction, the gas industry has gradually spread to Nagoya, Chiba, Narita. In 1877, the number of gas companies was only five; and from that year until 1907 no remarkable development was attained. Towards 1909, however, the industry made rapid strides. According to statistics compiled last year, the gas companies already in operation numbered 78, and those in course of construction and organization about 80—a phenomenon rarely met with in other countries. The distribution of gas represents 4000 million cubic feet, valued at 8 million yen, at the rate of 2 yen per 1000 feet. Compared with the figures for 1877, these show very striking development and progress.

Needless to say, we use a gas-meter in order to sell this greatly increased quantity of gas, with the result that the perfection and improvement of the meter is a matter of serious moment, and essential to the promotion of gas consumption. At the outset, we were relying solely upon imported gas-meters, and we could not manufacture them in our country. With the development of the industry, however, they gradually came to be manufactured in Japan, until now 99 per cent. of those used are the output of our factories, and are in every respect equal to those of foreign make. Thus we are no longer at the mercy of foreign supplies.

Nevertheless, we regret to find that Japanese meters are liable to error, as shown by the investigations and experiments carried on by the Department of Agriculture and Commerce for the period of one year beginning in 1912. According to this evidence, meters fresh from the factory are generally liable to go fast, resulting in loss to the consumer. The degree of advance is, however, differentiated according to the periods of using the machines. Taking an average, the rate is 2·5 per cent. in a year. Generally speaking, after this period, the meters are liable to go slow. The Department recently carried on an investigation concerning the accuracy of meters supplied to consumers by the Tokyo Gas Company, from which it appears that 33 per cent. are liable to error, 56 per cent. entail losses to the Company, and only 10 per cent. are accurate. In other words, only 46 per cent. conform to the legal standard. But though this evidence must convince you of the extent to which gas-meters are liable to error, it must not be supposed that Japan is peculiar in this respect. Even advanced countries such as England and Germany are not yet free from these undesirable occurrences; and they are therefore assiduously trying to effect improvement of the meter. In Germany, they have established an association for the purpose. To attain this object, we deem it necessary to alter the construction of the meter essentially. We are told that so far 125 of such improved meters have been patented.

It is, therefore, our earnest wish that those concerned in the industry will do their best to improve the Japanese machine; for unless steps are taken in this direction, we fear that the time is not far distant when we shall again see the import of far superior foreign-made meters—thus retarding the home manufacture. If our forecast is not mistaken, instead of only stopping at the mere improvement of the meter, we must strive to produce machines far excelling foreign ones, since, in our opinion, a perfect meter is an essential factor in the promotion of the gas industry, and will result in greater public credits. In Europe and America, the Governments supervise the meters, and control their uniformity. It is only in Japan that this restriction is not imposed. It will be possible therefore to see this take place at no distant date, if you do not succeed, as a body, in improving the present condition of gas-meters. Such a restriction would, of course, cause inconvenience to the general management of gas-works; and it is therefore your duty to make it unnecessary by reforming the existing state of affairs.

At the close of the address,

Count SHIGENOBU, the eminent statesman, and an honorary member of the Association, offered a few remarks on the subject of gas.

An entertainment and a banquet followed; and after a pleasant evening spent in social intercourse, the company separated, and brought the first day's proceedings to a close.

On the afternoon of the second day, the members and their families visited the Okura Fine Art Museum. It was arranged that on the third day there should be a garden party at the house of Count Okuma; but, owing to unfavourable weather, it had to be postponed till the following day.

Large Gas-Engines in Belgium.—According to an article by M. Léon Greiner in the "Revue Universelle des Mines et de la Métallurgie," there are 94 large gas-engines at present in use in Belgian works, developing a total of 128,700 H.P.

DEPRECIATION.

By F. S. Cripps, Assoc.M.Inst.C.E.

There is undoubtedly a great deal of conflicting opinion existing as to the depreciation of plant, and the place it should occupy in the accounts of an engineering undertaking. Perhaps the following report on the subject, which I prepared for a water company about eighteen months ago, may help to elucidate the subject, or at any rate serve to stimulate the discussion which it is hoped may follow the reading of Dr. Alex. Humphrey's paper at the meeting of the Institution of Gas Engineers. Mr. Humphrey's communication is sure to be appreciated in this country as giving the views held in the United States on this important subject.

Report on the Depreciation of a Water Company's Plant, and the Sums to be Set Aside Annually to Meet it.

The annual depreciation may be defined as the annual payment which, if placed at compound interest, will accumulate a fund equal to the first cost of the plant at the end of its life, *minus* any value it may have at the time it is discarded—that is, either sold as second-hand plant, or as old iron. The annual payments (the depreciation fund) may be invested either in gilt-edged stock or in the company's own business—for confirmation of which see auditor's report to the company on this point.

Invested in the company's undertaking, the money is worth 5 per cent., because if this is not done the company have to pay 5 per cent. for the extra capital (in the shape of dividends) in the place of it.

Hence I have taken the rate of interest to be paid into the fund by the company for the use of the money as 5 per cent. This must be still further increased in consideration of the rate of decay, which is less rapid at first than at the latter part of the life of the apparatus, as already explained in former reports. I allow an extra 1 per cent. only for this.

Briefly, the payment to be put aside annually must be an increasing sum, and is made up of (*a*) the annual payment, *plus* (*b*) compound interest at 6 per cent., which is 5 per cent. for interest on the money *plus* 1 per cent. for rate of decay. It is obvious that as plant is erected at various periods in the lifetime of the company, and, moreover, that as all plant has not the same life, the sums to be set aside must be varied to suit. It is convenient to group the plant according to its life and the time it has been in use, and then deal with the depreciation on each group. In the following tables this has been done. The last column of the first table gives all the company really require to know, so far as the plant now existing is concerned, for the next thirty years. The tables which follow indicate how the results in this first table have been arrived at. Every year the sums will be augmented; but now that the whole has been brought into line, there is no difficulty in doing this.

Summary of Payments Required to be Made into Depreciation Fund on Account of Existing Plant.

Year.	Machinery. Class I. Table V.	Boilers. Class II. Table VIII.	Mains, &c. Classes III. & IV Table XI.	Totals.
1912	333	54	73	460
1913	354	56	77	487
1914	271	60	81	412
1915	287	64	86	437
1916	303	68	92	463
1917	322	72	98	492
1918	341	77	104	522
1919	362	81	110	553
1920	147	87	116	350
1921	156	92	123	371
1922	165	44	130	339
1923	175	47	138	360
1924	185	50	147	383
1925	196	53	156	405
1926	208	..	165	373
1927	..	..	175	175
1928	..	..	185	185
1929	..	..	197	197
1930	..	..	209	209
1931	..	..	221	221
1932	..	..	234	234
1933	..	..	249	249
1934	..	..	264	264
1935	..	..	279	279
1936	..	..	295	295
1937	..	..	313	313
1938	..	..	332	332
1939	..	..	352	352
1940	..	..	373	373
1941	..	..	395	395
1942	..	..	419	419

Note.—The depreciation on new plant erected in every year after the present date, January, 1912, to be added at the end of each succeeding year.

Depreciation Table No. I.—January, 1912. *Showing Present Amount of Depreciation Fund and Value of Plant.*

A.	Class. Kind of Plant.	I. Engines and Machinery.				II. Boilers.		III. & IV. Mains and Wells.		Totals.
B	Year erected. . .	1897	1899	1905	1912	1902	1906	1892	1903	—
C	Cost	£500	£1,105	£2,436	£2,304	£662	£730	£29,158	£26,590	£63,485
D	Value at death . .	£75	£105	£136	£161	£62	£82	£2158	£1890	£4469
E	Net cost = C − D .	£425	£1,000	£2,300	£2,143	£600	£648	£27,000	£24,700	£58,816
F	Life, in years . .	15	15	15	15	20	20	80	80	..
G	Per cent. for interest and rate of decay.	6	6	6	6	6	6	6	6	..
H	Constant for annual payment . . .	·043	·043	·043	·043	·027	·027	·00057	·00057	..
I	Annual payment E × H	£18	£43	£99	£92	£16	£17·5	£15·4	£14	..
J	Age, to date . . .	15	15	7	..	10	6	20	9	..
K	Constant for age .	·043	·053	·12	..	·076	·143	·0272	·087	..
L	$\frac{H}{K}$	1·0	·81	·36	..	·35	·19	·021	0065	..
M	Present amount of fund = E × L .	£425	£810	£828	..	£240	£123	£567	£160	£3123
N	Present worth of plant = C − M .	£75	£295	£1,608	£2,304	£452	£607	£28,591	£26,430	£60,362

Present worth of plant subject to depreciation (N)		£60,362
Present amount of depreciation fund as above		3,123
Cost of plant, &c., not subject to depreciation:—		
Reservoirs	£10,845	
Buildings	4,319	19,769
Acts of Parliament, land, &c.	4,605	
Capital expenditure to December, 1911 (less written off for old plant disposed of)		£83,254

Explanatory Notes on Depreciation Table No. I.

Note A.—Class I. = Engines and machinery.
,, II. = Boilers.
,, III. = Mains.
,, IV. = Wells and borings.
Classes III. and IV., having the same life, are grouped together.
For reason given below, reservoirs, buildings, and meters are not included in this table.

Note B.—Is the approximate date when the plant was erected. The mains have been grouped as if laid in the two years given, to save unnecessary complications. Greater subdivision was first tried; but the result was practically identical, owing to the payments being spread over such a long period.

Note C.—Capital expended on plant, exclusive of that which has been disposed of and paid for out of depreciation fund or revenue.

Note D.—Value when sold second-hand or scrap as case may be. Amounts put down for engines, &c., are quite low enough.

Note E.—The net cost is the first cost less the amount it may be worth as old iron or for sale when the Company has done with it at its death.

Note F.—The life of plant varies; but the years given accord with the views of the best authorities.

Large well-made machinery is given a life of 30 or 40 years or more; but improvements and other considerations limit it to 25 or 30 years.

Light machinery is given 15 to 20 years' life. I have taken the smaller figure—viz., 15 years.

Boilers are allowed a life of 15 to 25 years. As you work your boilers half time, that is, alternately with one another, I have taken 20 years as a fair life.

Cast-iron mains are considered to last from 50 to 100 years or more, and, if properly coated, they depreciate very little, if at all. The Income-Tax Commissioners do not consider they suffer any depreciation; but I have taken 80 years as the fair average life of the mains.

Wells and Borings, &c., like the buildings, are kept in good repair out of revenue, and are not considered to depreciate; but I have included wells and borings as having the same life as the mains.

Buildings are not treated as subject to depreciation.

Reservoirs are still more durable—in fact, if kept in ordinary repair, are practically indestructible. A reservoir would, in the ordinary way, last over 200 years, and

still be as good as ever. The payments to reserve on this account would be so trifling, for the first 50 years at least, that, for all practical purposes they may be disregarded.

All *Ordinary Machinery* is embraced under Class I. with the pumping-engines.

Meters are not here included, as a separate account has always been kept of their depreciation. They are not charged to capital.

NOTE G.—The annual increment is taken at 6 per cent.—viz., 5 per cent. for the use of the money by the Company for purchasing plant, thereby deferring the raising of new capital; and 1 per cent. to allow for the more rapid decay of plant as its age increases. (See also special report on this).

NOTE H.—This is a multiplier obtained by the following formula:—

The annual rate of depreciation per unit of cost, or the annuity required to produce £1 at the end of N years,

$$= \frac{r}{(1+r)^n - 1} \text{ where}$$

r = the rate of interest (G) per £1

n = life of plant, in years (F).

NOTE I.—This (H) multiplied by the net cost (column E) will give the annual payment to be made to the fund in addition to the 6 per cent. interest on the previous year's payment.

NOTE J.—The years the plant has been in use prior to present date.

NOTE K.—Obtained by same formula as H.

NOTE L.—Is the value of the annuity (H) at the end of J years = the amount of depreciation per £1 at end of J years.

NOTE M.—This (L) multiplied by the net cost of plant (E) gives the present value of depreciation fund.

The actual amount of present depreciation fund (as given in balance-sheet) is £3148, which is for all practical purposes the same as the estimated total (M)—viz., £3123. £1002 have been deducted from the account previously for old boilers and other dismantled plant, which figures do not appear in these tables.

NOTE N.—M deducted from the first cost (C) gives the present worth of the plant.

DEPRECIATION TABLES NOS. II., III., AND IV.—January, 1912.

Depreciation During Life of Machinery—Class I.

Year.	6 Per Cent. G.	Annual Sum – I.	G + I.	Totals.
Erected about 1899 (Table II.)				
1911	..	..	..	810
1912	49	43	92	902
1913	55	43	98	1000
Erected about 1905 (Table III.)				
1911	..	..	..	828
1912	50	99	149	977
1913	59	99	158	1135
1914	68	99	167	1302
1915	78	99	177	1479
1916	88	99	187	1666
1917	100	99	199	1865
1918	112	99	211	2076
1919	125	99	224	2300
Erected in 1911 (Table IV.)				
1912	..	92	92	92
1913	6	92	98	190
1914	12	92	104	294
1915	18	92	110	404
1916	24	92	116	520
1917	31	92	123	643
1918	38	92	130	773
1919	46	92	138	911
1920	55	92	147	1058
1921	64	92	156	1214
1922	73	92	165	1379
1923	83	92	175	1554
1924	93	92	185	1739
1925	104	92	196	1935
1926	116	92	208	2143

TABLE NO. V.

Summary of Annual Payments Required, on Machinery Existing in January, 1912.

Year.	Erected about 1899.	Erected in 1905.	Erected in 1912.	Totals of G + I.
	£	£	£	£
1912	92	149	92	333
1913	98	158	98	354
1914	..	167	104	271
1915	..	177	110	287
1916	..	187	116	303
1917	..	199	123	322
1918	..	211	130	341
1919	..	224	138	362
1920	..	..	147	147
1921	..	..	156	156
1922	..	..	165	165
1923	..	..	175	175
1924	..	..	185	185
1925	..	..	196	196
1926	..	..	208	208

NOTES.—The annual sums added are taken from I in Table 1.
The depreciation to year 1911, with which the above Tables start, is also taken from M in Table No. I.

DEPRECIATION TABLES NOS. VI., VII., AND VIII.—January, 1912.

Depreciation during Life of Boilers—Class II.

Year.	6 Per Cent. G.	Annual Sum I.	G + I.	Totals.
Erected in 1902 (Table VI.).				
1911	..	..	..	210
1912	13	16	29	239
1913	14	16	30	269
1914	16	16	32	301
1915	18	16	34	335
1916	20	16	36	371
1917	22	16	38	409
1918	25	16	41	450
1919	28	16	44	494
1920	31	16	47	541
1921	34	16	50	591
Erected in 1906 (Table VII.).				
1911	..	..	..	125
1912	7·5	17·5	25	148
1913	8·5	17·5	26	174
1914	10 5	17·5	28	202
1915	12·5	17·5	30	232
1916	14·5	17·5	32	264
1917	16·5	17·5	34	298
1918	18·5	17·5	36	334
1919	20·5	17·5	38	372
1920	22·5	17·5	40	412
1921	24·5	17·5	42	454
1922	26·5	17·5	44	498
1923	29·5	17·5	47	545
1924	32·5	17·5	50	595
1925	35·5	17·5	53	648

TABLE NO. VIII.—*Summary of Annual Payments Required on Boilers Existing in January, 1912.*

Year.	Erected in 1902.	Erected in 1906.	Totals of G + I.
	£	£	£
1912	29	25	54
1913	30	26	56
1914	32	28	60
1915	34	30	64
1916	36	32	68
1917	38	34	72
1918	41	36	77
1919	44	38	81
1920	47	40	87
1921	50	42	92
1922	..	44	44
1923	..	47	47
1924	..	50	50
1925	..	53	53

DEPRECIATION TABLES NOS. IX., X., AND XI.—January, 1912.

Depreciation during Life of Mains, Wells, and Borings for the next Thirty Years. Classes III. and IV.

	Laid as in 1892 (Table IX.).				Laid as in 1903 (Table X.).				Summary of Annual Payments required on Mains, &c., Laid up to January, 1912. (Table XI.)
Year.	6 Per Cent. G.	Annual Sum I.	G+I.	Totals.	6 Per Cent. G.	Annual Sum I.	G+I.	Totals.	
1911	—	—	—	567	—	—	—	160	—
1912	34	15·4	49	616	10	14	24	184	73
1913	37	15·4	52	668	11	14	25	209	77
1914	40	15·4	55	724	12	14	26	235	81
1915	43	15·4	58	782	14	14	28	263	86
1916	47	15·4	62	845	16	14	30	293	92
1917	51	15·4	66	911	18	14	32	325	98
1918	55	15·4	70	981	20	14	34	359	104
1919	59	15·4	74	1056	22	14	36	395	110
1920	63	15·4	78	1134	24	14	38	433	116
1921	68	15·4	83	1218	26	14	40	473	123
1922	73	15·4	88	1306	28	14	42	515	130
1923	78	15·4	93	1399	31	14	45	560	138
1924	84	15·4	99	1499	34	14	48	608	147
1925	90	15·4	105	1604	37	14	51	659	156
1926	96	15·4	111	1716	40	14	54	713	165
1927	103	15·4	118	1834	43	14	57	770	175
1928	110	15·4	125	1959	46	14	60	830	185
1929	118	15·4	133	2093	50	14	64	894	197
1930	126	15·4	141	2234	54	14	68	962	209
1931	134	15·4	149	2384	58	14	72	1034	221
1932	143	15·4	158	2542	62	14	76	1110	234
1933	153	15·4	168	2710	67	14	81	1191	249
1934	163	15·4	178	2889	72	14	86	1277	266
1935	173	15·4	188	3077	77	14	91	1368	279
1936	184	15·4	199	3277	82	14	96	1464	295
1937	196	15·4	211	3488	88	14	102	1566	313
1938	209	15·4	224	3712	94	14	108	1674	332
1939	223	15·4	238	3951	100	14	114	1788	352
1940	237	15·4	252	4203	107	14	121	1909	373
1941	252	15·4	267	4471	114	14	128	2037	395
1942	268	15 4	283	4754	122	14	136	2173	419

NOTE.—This table can be extended for the full life, when occasion arises.

THE STANDARD SPECIFICATION OF STREET LIGHTING.

An Addition to the Recent Discussion.

Growing out of the recent discussion at the meetings of the Illuminating Engineering Society—as reported in the "JOURNAL," *ante*, pp. 250-258 and 397-404—Mr. W. J. Liberty, the Inspector of Public Lighting for the City of London, contributes an article to the June number of the "Illuminating Engineer," as time did not, he says, allow him to take part in the discussion on Mr. Trotter's paper. Had he done so, it was his intention to have given some data which he had collected during many years of experience in the City of London, especially with regard to the experiments made with gas and electricity in the City during the last ten years, down to the "last word" in street lighting.

Mr. Liberty proceeds: First, however, let me remark that I agree with Mr. Watson, of Doncaster, that 10 feet is not the correct height for the low-illumination lamps on columns—12 feet (certainly not less than 11 ft. 6 in.) is found in practice to be the lowest the lamps should be fixed. At that height, they are above the line of vision.

The following are a few diagrams giving heights and spacings, showing the following: (*a*) Heights of lamps above the footway or carriage-way; (*b*) Distances apart of lamps; (*c*) Width of the roadway; (*d*) Polar curve (where possible); (*e*) Long brackets over the footway; (*f*) Columns on the side-walk; (*g*) Columns down centre of roadway; (*h*) Centrally-hung lamps (gas and electricity).

Fig. 1 makes it evident that our friends in the United States favour a zone considerably lower than that customary on this side of the water. The following table, containing some data on Continental practice, shows that Paris also favours low columns.

Height of Lamps—Continental Cities, 1909.

Name of City.	Flame Arc Lamp.	Electric Glow Lamp.	High-Pressure Gas-Lamp.	Low-Pressure Gas-Lamp.
	Posts (in feet).	Posts (in feet.)	Posts.	Posts.
Berlin	26 to 39·52	..	14 ft. 7 in. to 18 ft. 7 in.	11 ft. 5 in. to 14 ft. 7 in.
Brussels	..	..	..	11 ft. 5 in. to 14 ft. 7 in.
Cologne	26 to 33	11·5	..	11 ft. 5 in.
Dresden	26	10, 16, 26	..	10 ft. 6 in.
Düsseldorf	29 to 33	..	..	10 ft. 2 in.
Munich	33	13	..	11 ft. 5 in.
Paris	13 to 20	..	..	11 ft. 7 in.
Vienna	26 to 39	..	23 Centrally hung.	11 ft. 5 in.
Stuttgart	..	..	24 ft. to 28 ft.	..

N.B.—The heights are from the roadway to the burner.

Fig. 2 may be conveniently compared with the figures in the table. It shows the level of lamps customary in the Metropolis—including centrally suspended, experimental, and permanent systems; the heights and spacing having been decided upon

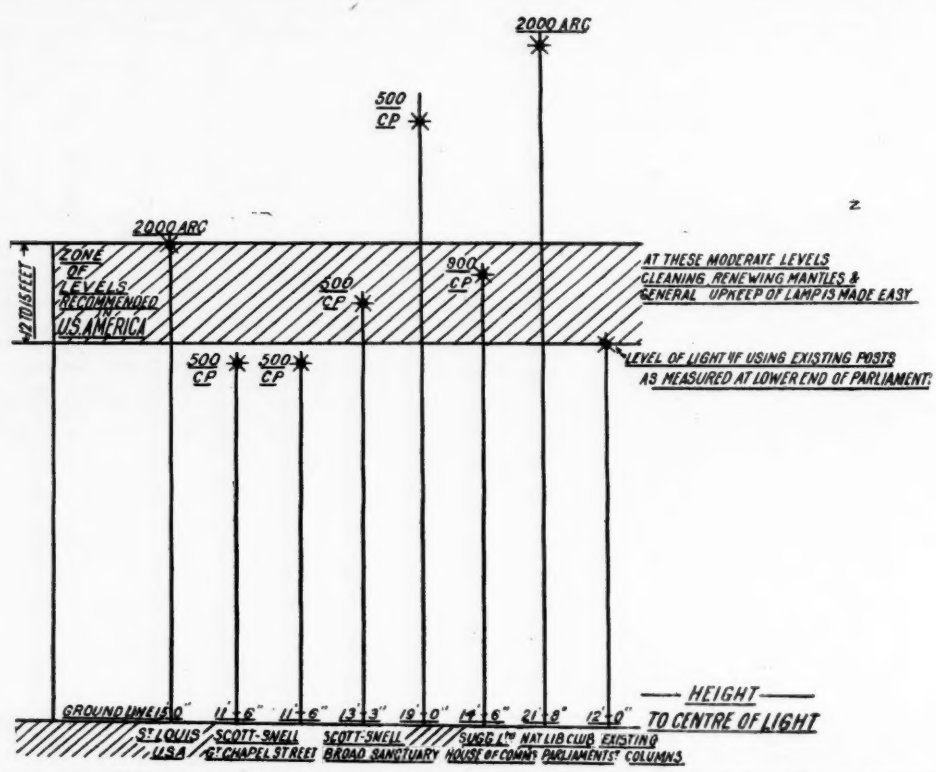

2000 ARC
500 CP
2000 ARC
ZONE OF LEVELS RECOMMENDED IN U.S. AMERICA
27 TO 35 FEET
500 CP
900 CP
500 CP
500 CP
AT THESE MODERATE LEVELS CLEANING, RENEWING MANTLES & GENERAL UPKEEP OF LAMPS IS MADE EASY
LEVEL OF LIGHT IF USING EXISTING POSTS AS MEASURED AT LOWER END OF PARLIAMENT
HEIGHT TO CENTRE OF LIGHT
GROUND LINE
15'0" 11'6" 11'6" 13'3" 18'0" 14'6" 21'8" 12'0"
ST LOUIS U.S.A.
SCOTT-SNELL 6 CHAPEL STREET
SCOTT-SNELL BROAD SANCTUARY
SUGG 1ND NAT LIB CLUB EXISTING HOUSE OF COMMS PARLIAMENTS COLUMNS

Fig. 1.—DIAGRAM COMPARING THE HEIGHTS OF LAMPS COMMONLY USED IN THIS COUNTRY AND THE UNITED STATES.

according to the nature of the thoroughfare and the experience gained as regards the requirements of traffic.

Next Mr. Liberty gives some night views of London streets, photographed entirely by artificial light. These (or some similar) photographs have already appeared from time to time in the "JOURNAL." For instance, the night view of Fleet Street, lighted by high-pressure gas lamps of 1500-candle power, hung on long brackets fixed to the house fronts, was given in the number for April 6, 1909 (p. 22).

The author then has a series of diagrams showing the illumination derived from various arc and metallic filament lamps used in some of the streets referred to—viz., "Oriflamme" lamps in Cheapside, "Excello" arcs in Farringdon Street, and metallic filaments in the side streets. His final illustration gives details of the suspension gear now being used for lamps hung over the centre of the roadway.

Mr. Liberty remarks as to fig. 3 that these details of actual practice may be of some use, although there are other factors of a local character always to be taken into account. For instance, Cannon Street and Cheapside—two parallel roads in the City of London—are each lighted with centrally hung flame arc lamps. Both thoroughfares are approximately the same width; yet the spacings are 138 feet and 90 feet respectively; the reason being that the former road is used principally for through traffic, and has an absence of shops, while the latter is crowded with pedestrians, and full of shops and plate glass. The nearness in the spacing of the latter is counterbalanced by the fact that alternate lamps are extinguished at midnight. This illustrates how special consideration must always be given to localities.

Recent Weddings.—Mr. Stanley Hunter Jones, son of Mr. Henry E. Jones, of Marden Ash, Ongar, was married last Saturday to Miss Mary Bateman, only daughter of the late Captain Richard Bateman, R.N. The ceremony took place at St. Peter's, Cranley Gardens, and afterwards a reception was held at No. 80, Elm Park Gardens. On Monday of last week, Dr. Leonard A. Levy, M.A., F.I.C., F.C.S. (whose interesting contribution to the "JOURNAL" appeared in the issues for May 13 and 20), was married at the West Hampstead Syngagogue to the only daughter of Mr. and Mrs. Mark Samson, of Shoot-up Hill, Cricklewood. At St. Mary's Church, Elland, on the 5th inst., the marriage was solemnized of Mr. Edward Garsed, the Hon. Secretary of the Yorkshire Junior Gas Association, and Miss May Eveline Aspinall, of Elland. Among the presents was cutlery from the Directors of the Kippax Gas Company, with which he is associated.

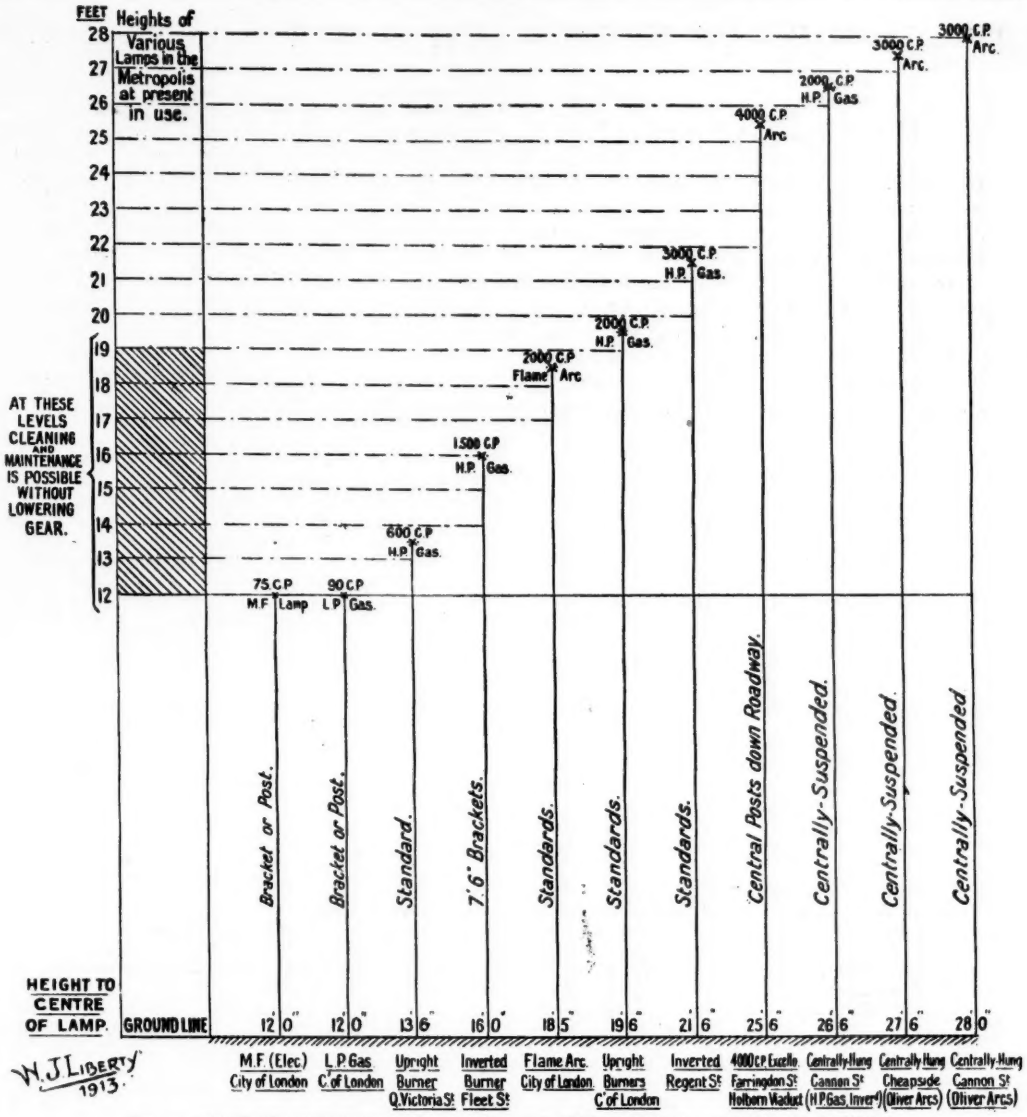

FEET
Heights of Various Lamps in the Metropolis at present in use.
AT THESE LEVELS CLEANING AND MAINTENANCE IS POSSIBLE WITHOUT LOWERING GEAR.
HEIGHT TO CENTRE OF LAMP.
GROUND LINE
3000 C.P. Arc.
3000 C.P. Arc.
3000 C.P. Arc.
2000 C.P. H.P. Gas.
4000 C.P. Arc
3000 C.P. H.P. Gas.
2000 C.P. H.P. Gas.
2000 C.P. Flame Arc
1500 C.P. H.P. Gas.
600 C.P. H.P. Gas.
75 C.P. M.F. Lamp
90 C.P. L.P. Gas.
Bracket or Post.
Bracket or Post.
Standard.
7'6" Brackets.
Standards.
Standards.
Standards.
Central Posts down Roadway.
Centrally-Suspended.
Centrally-Suspended.
Centrally-Suspended.
12 0" 12 0" 13 6" 16 0" 18 5" 19 6" 21 6" 25 6" 26 6" 27 6" 28 0"
M.F. (Elec) City of London
L.P. Gas C. of London
Upright Burner Q. Victoria St.
Inverted Burner Fleet St.
Flame Arc. City of London.
Upright Burners C. of London
Inverted Regent St.
4000 C.P. Excello. Farringdon St. Holborn Viaduct
Centrally-Hung Cannon St (H.P. Gas. Inverts)
Centrally Hung Cheapside (Oliver Arcs)
Centrally-Hung Cannon St (Oliver Arcs.)
W. J. Liberty 1913.

Fig. 2.—DIAGRAM SHOWING THE LEVEL OF THE VARIOUS LIGHTS IN LONDON.
(As now existing.)

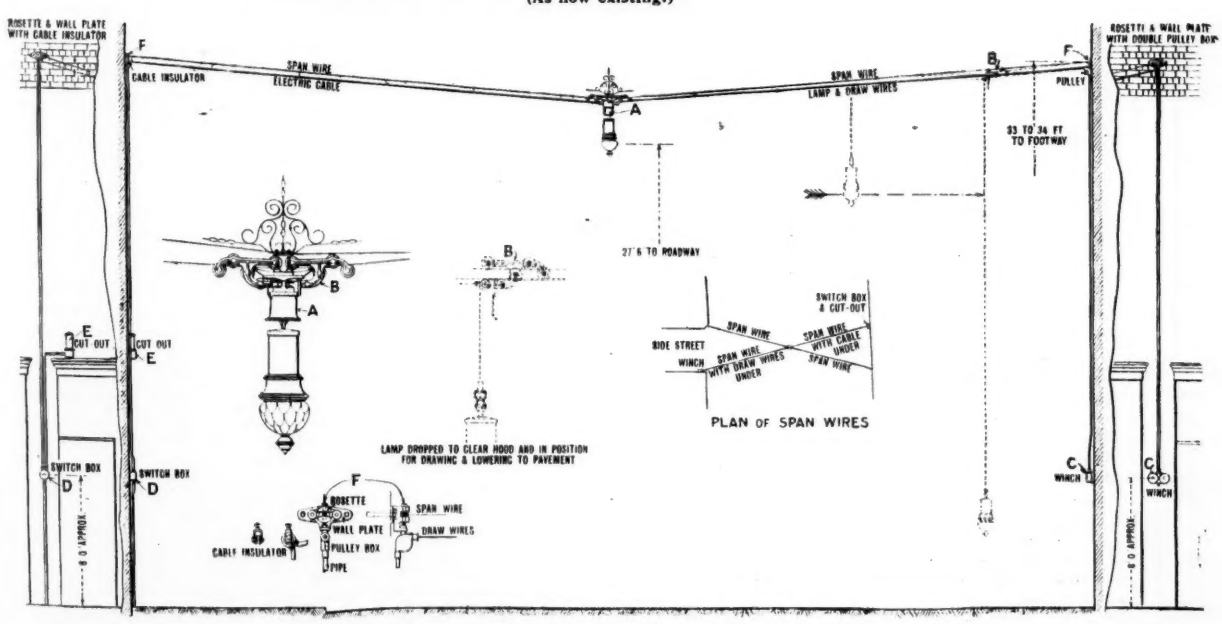


Fig. 3.—CENTRAL SUSPENSION SYSTEM IN USE IN CHEAPSIDE.

The Liberty and Property Defence League, of No. 25, Victoria Street S.W., have issued a "Statistical Monograph" giving the results of a minimum wage, according to the latest proposals as applied to five great industries. Two specific demands for a minimum wage have, it is pointed out, been formulated during the present year—one for 35s. per week for all male employees and 25s. for women, the minimum for youths to average 22s. and for girls 18s.; and the other for a minimum of 30s. per week for all adult employees in urban districts, men and women alike. It is demonstrated that the minimum wage would wipe four of the trades out of existence, since the total wages bill would in each case exceed the net selling value of the goods produced. In the case of the fifth (engineering), nothing would be left but a precarious balance, amounting to hardly more than ½ per cent. of the capital employed in the undertakings, to stand between its continuance and bankruptcy.

UNITED MEETING OF THE ENGLISH JUNIOR GAS ASSOCIATIONS.

Sheffield's Warm Welcome.

It has been the custom—and a good custom it has proved—for the four English Junior Gas Associations to hold a combined meeting every second year; and last Saturday was the date fixed for the fourth of these gatherings. The three previous meetings had taken place respectively in Manchester, London, and Birmingham; and on this occasion the arrangements were in the hands of the Yorkshire Junior Association. Again, in Sheffield, an excellent choice of place was made; for the city is one which, in addition to its many other industrial activities, is of peculiar interest to the gas industry. The members of the Associations are far separated; and distance is, of course, a serious consideration. When this is borne in mind—and other circumstances which affected the attendance from the Southern area—the muster on Saturday was a highly gratifying one. The Sheffield United Gaslight Company and their Engineer (Mr. J. W. Morrison) know how to do other things besides make and sell gas; and the members of the Junior Associations will long remember the cordial welcome and the generous hospitality received at their hands. The day was a full one; and the enjoyment of the excellent programme drawn up was added to by the delightful weather conditions.

On Saturday morning, the Grand Hotel, in Leopold Street, Sheffield, was the scene of unusual bustle; for the order was that the members of the four English Junior Gas Associations who were taking part in the day's proceedings should assemble there, preparatory to dividing up for the alternative morning visits. Here they were met by members of the Arrangements Committee, and were welcomed by word and deed. It must, before going farther, be stated that the Arrangements Committee consisted of Messrs. E. Garsed, A. L. Holton, and J. W. Lee, who were assisted by Mr. J. W. Morrison, the Engineer of the Sheffield United Gaslight Company. The private arrangements of Mr. Garsed (who is the Hon. Secretary of the Yorkshire Junior Association) necessitating his absence from home, his share of the work was taken up, and enthusiastically performed, by Mr. Lee, who began by explaining the arrangements made. Three alternative visits had been planned for the morning; and every member outside the Yorkshire Association was placed in the party he had selected. The necessity for making the parties fairly balance, however, called for a little sacrifice of wishes on the part of some of the Yorkshire men—which was willingly made.

Mr. Morrison, on behalf of the Directors of the Gas Company, offered the visitors a very hearty welcome to Sheffield, where he thought the name of the gas industry was always held in high esteem. He referred to the interesting morning's visits that had been planned, and pointed out that at the works of the Nunnery Colliery Company there was an instance of an industrial development which was progressing very rapidly in this country—the recovery of bye-products from coal at the pit-mouth. It was of great importance to gas men to watch what was being done in this direction. To successfully meet competition, from whatever source, the gas industry must do their utmost to sell their commodity at the lowest possible price. When they visited the gas-works in the afternoon, he hoped the members would be interested in what they saw. The Company had not gone in for vertical retorts; but they were able to produce gas at such a cost that they could sell it at a very cheap rate.

A start was then made with the morning's visits; some brief notes of which are appended.

Nunnery Coke-Ovens and Bye-Products Plant.

The party proceeding (under the guidance of Mr. A. L. Holton) to inspect the coke-ovens and bye-products plant of the Nunnery Colliery Company, after a short tram-ride, soon found themselves at their destination. They were met by Mr. T. A. Long (the Manager of the bye-products ovens), Mr. W. Long (the Manager of the coal-washer), Mr. White, and Mr. Mascall, who took them round, and answered every question.

A start was made at the coal-washer, and it was pointed out that the Company keep their fine smudge for coking purposes. This could now be sold at 10s. per ton; but by coking it, they do better than that. All kinds of coke are made at the collieries—that suitable for steel melting as well as for blast furnaces. There is at present installed a row of forty Otto-Hilgenstock ovens, making hard coke; and ten more are being put down. The coal is taken up by an electrically driven elevator to a Karr's disintegrator, which reduces it to what is practically a fine sand; no piece after passing through being bigger than $\frac{1}{16}$ inch, so that it knits well together. When ground, the coal carries 10 to 12 per cent. of moisture from the washing; and no further water is added.

Eight tons of coal are placed in each oven; and this produces between 5 and 6 tons of coke. Inquiry elicited the fact that the firm have never had a complaint of sulphur since they started the plant. As a matter of fact, the percentage of sulphur in the coke is about 1·2. The ovens are charged by means of three filling holes in the top; two travelling bogeys of coal being emptied into each hole. The disintegrated coal is elevated into a storage hopper holding 600 tons, from which these bogeys are filled. A patent appliance is used for levelling the charge of coal in the ovens; but no stamping is done. From 32 to 33 hours are allowed for carbonizing; and the coke is then pushed out and quenched by an overhead spray of water under 60 lbs. pressure. The time occupied in pushing out is 5 minutes, which allows of proper cooling. As the coke falls, it is protected by a swinging shield, which prevents it from being too much broken. The visitors commented upon the excellent appearance of the coke produced, and were told that it contained 2·5 per cent. of moisture.

The gas as it leaves the ovens passes up the ascension-pipe to the hydraulic, and then goes through a long length of main for slow condensation. After further cooling plant, the exhausters are reached—running at 3000 revolutions per minute, driven by a steam-turbine. This is followed by the process for the direct recovery of sulphate of ammonia. The members were shown the salt in store, and its good colour was generally admitted. The secret of getting a white salt, Mr. Long explained, lies in removing the last traces of tar from the gas. For the purpose of securing this removal, the gas is sprayed with the thin tar which constitutes the first running from the ovens—somewhat after the principle of "setting a thief to catch a thief." If there is any discoloration of the salt, it is because the tar spray is not working properly. When entirely freed from tar, the gas comes in contact with sulphuric acid in the saturator; the sulphuric acid being circulated by means of compressed air. When a certain strength of crystals is reached, the sulphate is dropped into a centrifugal drier. The process is a continuous one. Recovery of ammonium chloride is carried out in connection with the plant. At present the benzol is not taken from the gas; but plant is being put down for this purpose.

The processes referred to having been completed, the ammonia-freed gas is taken back to heat the ovens, for which purpose burners are provided having holes in the sides for drawing in the air required. The gas not so used goes to waste. As to temperature, the ovens are kept at 850° C. They could easily be worked higher; but if he exceeds this temperature, Mr. Long's experience is that he loses in ammonia. The products leave the ovens at a sufficient heat for use under the boilers; and from there they pass into the chimney-stack. Electricity is generated by an exhaust steam turbine, supplemented by a small amount of live steam; and a voltage of 250 is used throughout the whole place.

The inspection completed, a hearty vote of thanks was, on the proposition of Mr. C. E. Woodhead, of the Manchester Association, passed to the Directors of the Colliery Company for allowing the visit, and to Mr. Long and his assistants for their kindness in explaining everything and conducting them round the works. Mr. A. Edwards, of the Yorkshire Association, when seconding, referred to the fact that coke-oven bye-products recovery plants are really only recent introductions. He said the owners had had the benefit of all the researches and the improvements which had come on the market, and had much better means at command for recovering residuals than were to be found on an ordinary gas-works. With the plant just seen they were manufacturing sulphate of ammonia, obviously exceedingly white and saleable, by means of passing the gas directly through sulphuric acid—which was a huge economy. They were also evidently looking after their ammonia residuals in other directions, for they were recovering ammonium chloride. This was an important consideration, when they remembered the price at which it was saleable. Mr. Holton remarked that, as a gas-works chemist, he envied the position of their coke-oven friends, because they had opportunities for research in connection with recovery processes which were not obtainable on a gas-works.

Messrs. John Brown and Co., Limited.

Tickets for this visit were much in request; and as visitors had been asked to state the order of their preference for the various morning visits, it had been arranged that, as hosts, the Yorkshire members should, in the main, step aside and let all their guests who wished to see these world-famed works have the opportunity. Most Sheffield works—especially in the heavy trade—cease work for the week-end on Friday night; so that a Saturday's visit is hard to arrange, and in any case is not quite so complete as on an earlier day in the week. In fact, much of the work actually seen in operation had been on this occasion continued until Saturday noon for the special benefit of the Associations. To this party, Mr. Eric Morrison acted as guide.

After a welcome from the Secretary of the Company, the visitors were divided up into small groups and shown round. Detailed description is hardly possible, amid the many noises of the work; while too pointed inquiries are not encouraged at works whose specialities are of such importance, and Government contracts

so numerous, as at Messrs. Brown and Co.'s. Still, everyone had a revealing experience of the magnitude of all the operations, in size of machines, size and weight of armour plates, turbine drums, crank-shafts, &c., and in the facilities for easily lifting and conveying heavy weights. The Mond gas plant was seen, and rather longingly scrutinized; but time did not permit of a very close examination of it. Coming just as work was ending for the week, the Bessemer converters and rolling mills for steel were not seen in operation; but the casting of steel ingots was in full swing as the visitors passed through. The rims of railway-wheels were shown under the steam-hammer, and in an adjoining department the construction of carriage springs and the testing of the finished spring with a pressure of 20 tons were watched.

Representatives of the various Associations interviewed the Secretary at the close, and conveyed to him their colleagues' warm thanks for the privileges extended to them that morning by the firm.

Messrs. J. Rodgers and Co.

A second party had been arranged for one of the representative cutlery and electro-plating works; but as the time for the visit drew near, it was found necessary to cancel the invitation. With great kindness, Messrs. Jos. Rodgers and Co., another well-known firm engaged in the same branches of work, arranged at short notice to retain their men at work and invite the Associations to go round their premises.

Though pretty completely remote from gas interests, the visit gave great pleasure to the large party who (under the guidance of Mr. Lee) participated in it—having the charm of novelty to most.

Luncheon.

Shortly after one o'clock, the three parties met again at the Grand Hotel, where they were the guests at luncheon of the Sheffield United Gas Company. Mr. J. W. Morrison presided; and about 120 sat down to enjoy the good fare provided and the music which accompanied it. Those present included the Presidents of all four Associations—Mr. S. A. Carpenter (London and Southern District), Mr. W. L. Heald (Manchester and District), Mr. F. Shewring (Midland), and Mr. W. Walker Atley (Yorkshire). The speeches of the day were marked by brevity, for there was much to do, and by cordiality, for there was much to acknowledge. After Mr. Morrison had given "The King,"

Mr. W. L. Heald proposed a hearty vote of thanks to the Directors of the Sheffield United Gas Company and to Mr. Morrison for the hospitable manner in which they had been entertained, and for the permission to look over their works. He remarked that Sheffield stood out pre-eminent in the gas profession in more respects than one. They regarded them chiefly as sellers of gas, perhaps, but when they went to Neepsend, he believed they would see charges put in the retorts which were not equalled by any other undertaking in the kingdom. He had inspected many installations of inclined retorts; but he had not yet seen anywhere charges put in with the degree of accuracy that they had attained at Neepsend. There were some who still believed in horizontal retorts; and it seemed as if verticals had some way to go to get up to the Sheffield standard. The gentleman at the head of the Sheffield Board was Mr. Wilson Mappin; and in expressing their thanks, they must certainly not forget what they owed to him. The same applied to Mr. Hanbury Thomas, who had done so much good work for the Sheffield Company.

Mr. S. A. Carpenter, in seconding, said that ten years ago, Junior Associations were hardly known; whereas now they were of great importance, not only to the individual members, but he believed to the industry with which they were connected. It was a matter of great regret that the London and Southern District Association were not more strongly represented that day; but the annual outing to Hastings (the date of which was fixed nearly a year ago) took place on the previous Saturday, and it was, of course, difficult for members to get two consecutive Saturdays off. Further, they had been unable to get any facilities from the railway companies.

Professor Cobb (Livesey Professor at Leeds University), in supporting the resolution, remarked that one could not help feeling that gratitude was due to the Directors of the Company. He was present as representing a University which was determined to found a school specially for the training of gas engineers; and he owed a special debt of gratitude to the Yorkshire Junior Association and to the Sheffield Gas Company for the opportunity of becoming acquainted with so many of those present. He was delighted to recognize the splendid *esprit de corps* which could bring together from a distance such a number of men to attend a conference of this character; and he congratulated the Associations upon it. Mr. Morrison he had met in another capacity, as he was a member of the Committee which criticized in a very friendly way his (the speaker's) administration of the Department of Coal Gas and Fuel Industries at Leeds.

The vote having been carried by acclamation,

Mr. Morrison thanked them on behalf of the Directors, who, he was sorry to say, were not represented. When he approached his Board, there was no question at all as to whether they should entertain the Associations. They all felt that they would be only too delighted to see them. They had had both the Seniors and the Juniors in Sheffield; and at all times they were, and would be, only too pleased to show anything they had to them, either collectively or individually. The proud position that Sheffield occupied to-day was due to the exceptionally brilliant management of one whose name was so well known to the gas fraternity. He referred to the late Chairman, Sir Frederick Mappin. For some thirteen years, he (Mr. Morrison) occupied the position of Engineer under him; and he always looked to him for guidance. They had made big strides in Sheffield, where they had a keen competitor in the Corporation Electrical Department—which, by the way, had also a very keen competitor indeed in the Gas Company. There was a determination on behalf of gas to keep the flag flying in Sheffield. Taking, for example, the present year to date, they had had an increase in consumption of about 15½ per cent. compared with the corresponding period of 1912. When they considered the magnitude of the undertaking, which sent out close upon 5000 millions a year, it would be recognized that such increases meant large additions to the works. As a matter of fact, they were at the present moment well on with a scheme for erecting a 5½ million cubic feet per day works on horizontal lines. Before recommending his Directors to adopt this scheme, he went very carefully into the question of vertical retorts. He liked verticals very much; but unfortunately he could not pay the price that was asked for them. He calculated that he would be able to build his retort-house, fully equipped in every sense, for something like £100 per ton per day, whereas the best with verticals was from £160 to £180 per ton. One point he wished to mention was in reference to the work the Company were doing in connection with furnaces and gas-engines. They must not forget that, of course, the electric light had come to stay; and they must not lose any opportunity of seeing whether they could make new work for their commodity. As regarded furnaces and gas-engines, they were going ahead with enormous strides in Sheffield. Last year they put down 80 engines of a total capacity of 2600 B.H.P., some of them running as high as 300 H.P.; and this was a great asset. This year they had topped these figures by a good deal; for already there had been fixed, or were being fixed, 45 engines, with a total capacity of 1900 B.H.P. He would like all who could do so to take the opportunity of inspecting the Company's furnace-room, and see what was being done in the way of pushing the use of gas in connection with various industries. As a matter of fact, they had not done anything with high pressure; but they could show their visitors what it was possible to accomplish with the low-pressure gas which was at the finger-ends of all of them. Gas was sold in Sheffield at so low a price (the price was from 10d. to 1s. 3d. per 1000 cubic feet, and the average last year was 1s. 1d.) that high-pressure gas did not appeal to them so much as it might do in Birmingham, for example, where the price was nearly double that. In conclusion, he thanked them on behalf of the Directors for their visit to Sheffield, which he hoped would prove instructive; and he trusted they would go away with good recollections of what was supposed to be "a dirty picture in a gold frame."

Rising from the tables, the visitors found awaiting them at the hotel door special tramcars provided by the Gas Company to take them, some to the Neepsend and others to the Grimesthorpe works.

Neepsend Gas-Works.

The fact that the Sheffield United Gaslight Company are world-famed for the low prices charged for their gas, naturally made the visitors anxious to see, so far as they could from an inspection of the works, "how it is done." They did learn a good deal, and will be able to gather more, if they will turn to the number of the "Journal" in which was published the Inaugural Address delivered by Mr. Morrison to the Manchester District Institution of Gas Engineers in February, 1909. In his address, Mr. Morrison gave nine facts which are well worth study, as partly explaining the low gas charges in the city. Speaking generally, it may be said that the Company supply an area of 135 square miles, and have 600 miles of mains. There are 103,000 consumers; and the Company are carbonizing over 400,000 tons of coal a year. The three manufacturing stations are Neepsend (with a capacity of 11 million cubic feet per day), Grimesthorpe (5½ millions), and Effingham Street (4 millions). The total manufacturing capacity is thus 20½ million cubic feet per day. As mentioned by Mr. Morrison at the luncheon, the gas consumption up to date this year shows over 15½ per cent. increase as compared with the corresponding period of 1912.

The large party who proceeded to Neepsend, found themselves under the able guidance of Mr. Morrison, Mr. Shapley, Mr. Hoggard, and Mr. J. T. Sheard. In the first retort-house, they saw West compressed air stoking machinery, working on eight-hour charges of about 11 cwt. in 20 feet through retorts; the coke being discharged into barrows, and wheeled out of the house.

From this they passed to the re-constructed retort-house, which was fully described and illustrated in a paper that Mr. Morrison read before the Manchester Institution of Gas Engineers a little over eighteen months ago. As this appeared in the "Journal" for Oct. 31, 1911 (p. 301), there is no need to go into details here. It may be said, however, that the house contains two benches, each consisting of twelve beds of tens, five tiers high; the retorts being 22 feet long, and of a rounded Ω section, 24 inches wide by 16 inches deep. The regenerators are of the modified Klönne type having one deep furnace on the coke-discharging side of the beds. Seven-inch ascension-pipes are placed on both sides of the retort-bench. With a view to filling the retorts as full as possible, Arrol-Foulis hydraulic charging machines (operating on each side of the bench) were installed; and with these it is found that charges up to 18 cwt. can be put in the retorts. As a matter of fact, with the coals used twelve-hour charges of about 17 cwt. are found best. The discharging is effected by means of a Hunter-Barnett hydraulic pusher; and the satisfactory working of both machines was commented upon when the visitors were watching the operations of charging and discharging. As the coke leaves the retorts, it falls into large skips which hold about 24 cwt. (or the contents of two retorts); and it is then taken on a telpher rail, dipped in a water-tank, and tipped into a hopper or on to the heap. By this method so little breeze is produced that the make of coke is substantially more per ton than used to be the case. Stopped pipes, it was learnt, have been practically unknown since the house was started up.

Among other interesting points in the works was the 8 million cubic feet holder which is understood to be the largest in Yorkshire. Those who look up Mr. Morrison's address to the Manchester Institution will see that among his reasons for being able

to sell cheap gas was that the Company had always made it a rule to carry out extensions of mains and plant when trade was bad, so that they could get the benefit of low prices. As an instance of this he cited the holder alluded to, which was built at a cost of about £6800 per million feet of storage. There are four lifts—one being a flying lift; and the tank is a concrete one, 250 feet in diameter, and 43 ft. 6 in. deep. A further point of interest was the fact that there are practically no naphthalene troubles in Sheffield now, though they were at one time very prevalent. By means of compressed air, naphtha is blown through a spray into the main on the outlet of the meters, so as to come in contact with the gas on its way to the holders. The amount of naphtha used varies from 0·1 to 0·25 gallon per ton of coal carbonized.

All the works are coupled together; boosters and exhausters being provided, so that a station which requires gas can be supplied with it from another that has it to spare. Sheffield, owing to the greatly varying altitudes, is not an easy district to supply. The Company aim at giving no one in any part of the area less than 2 inches pressure; and district governors are installed at different elevations. Before leaving, attention was bestowed upon the laboratory and the experimental gas-making plant.

Grimesthorpe Gas-Works.

Those who chose to go to these works, did so either because they had already visited the main works at Neepsend, or because they were interested in the chemical works. Here is a complete sulphuric acid works, where all the spent oxide produced at the various Sheffield Gas-Works is burned and worked-up into vitriol. All the gas liquor is also treated in the usual way and converted into sulphate of ammonia. Extensive additions to the gas-works proper are in progress, though as yet only at the preliminary stages. As Mr. Morrison pointed out, last year's increase of gas sales by itself represents the make of a large works. The extended purifier-house is ready (at least the shell of it is), an extra station-meter was seen in course of erection, as also were some new washer-scrubbers; while the site of the new retort-house is being quarried so as to level it. New holders are impossible, as no more room is available. The Neepsend works have the main storage capacity; Grimesthorpe only possessing 3,600,000 cubic feet storage, while its maximum day's output is 5,250,000 cubic feet. The remainder is transferred to the other works by boosting—Sturtevant fans, able to transmit about 350,000 cubic feet per hour, being installed. For this purpose, a pressure of 14 inches is sufficient. When the extensions are complete, the maximum capacity of the works will be about 10 million cubic feet.

The retort-house has thirty settings of ten through retorts in five tiers, and operated by West's compressed-air machines. Helps's dry mains are in use on the settings; and, as at the other works in Sheffield, built-up retorts are employed. The coke is discharged into receivers immediately below the floor, slaked from a hose-pipe, and then dropped into large buckets travelling on an endless rope, which takes them out of the house.

The works are on the site of an old brickyard. In some places—*e.g.*, the site of the new retort-house—stone exists to some height above the general yard-level; while in others the tipped made-ground has to be dug out to a great depth before foundations can be laid. Parts of the new purifier-house rest on a 28 feet depth of concrete arches. The workshops are rather more extensive than at many similar works.

Mr. E. Fearon, the Works Superintendent, conducted the visitors round.

Tea—and Thanks.

After an instructive afternoon, the members once more assembled at the Grand Hotel, this time for tea, at which Mr. Morrison again kindly presided. Before a start was made on the final visit of the day, to the handsome gas offices, show-rooms, and furnace laboratory, in Commercial Street, certain well-deserved thanks were expressed in appropriate terms.

Mr. R. S. Ramsden (Midland Junior Association) proposed a vote of thanks to the Yorkshire Junior Association and the Arrangements Committee, for the splendid time they had given the visitors that day. He made particular mention of all the work done by Mr. Lee.

Mr. Ernest Scears (London and Southern Association) seconded, and said those who had been privileged to take part in the day's proceedings had not only enjoyed themselves thoroughly, but had also learnt a great deal. It would be a good thing if they could have these united meetings more often. He hoped when the Junior Associations came to London in October the members would turn up in good numbers. They would receive a warm welcome.

Mr. W. Walker Atley (Yorkshire Association) acknowledged the vote—which was cordially passed—on behalf of his Association and the Arrangements Committee. It had, he said, been a great day for them; and for its success they were greatly indebted to Mr. Morrison. Of course, they had a most energetic Secretary, and much was due to his labours.

Mr. J. W. Lee also replied, and pointed out that he had really acted as a sort of "stop-gap," as their Secretary had decided that this was the best time he could select to get married. The work had been much lightened by the assistance rendered all along by Mr. Morrison. They owed the day's visit and its success more to Mr. Morrison than to anyone else.

Mr. W. H. Johns (Midland Junior Association) proposed a hearty vote of thanks to their Chairman, Mr. Morrison, for all that he had done for them. He said he did not think he had ever seen such good working in the retort-house as he had at Neepsend that afternoon. Mr. Morrison and his assistants had given them every explanation they desired.

Mr. W. E. Caton (Midland Junior Association) seconded the proposal, and it was carried with loud applause.

Mr. Morrison, in acknowledgment, remarked that anything he could do for the gas industry he always endeavoured to do to the best of his ability. They had shown them what they had to show; and at any time the Associations cared to visit him or his assistants, they would be pleased to do so again.

Show-Rooms and a Furnace Laboratory.

Attractively fitted though the show-rooms proved to be, and copious as were the samples of lamps, pendants, shades, cookers, gas-fires, &c., on view, a comparatively brief survey was given to them, the purpose and interest of the visit centring in the newly-erected furnace laboratory in the yard at the rear of the building. Though not exactly a new departure, it represented the latest developments of the Company's enterprise. The building itself has only just been finished, and the whole exhibit is on an extensive scale.

The Sheffield metal trade may be conveniently divided into the heavy trade (as exemplified by armour plating, ship crank-rods, and turbine drums, as seen at the morning visit to Messrs. John Brown and Co.), and the light trade—cutlery, tool-making, and electro-plating (seen at the visit to Messrs. Rodgers and Co.). For the many furnaces used by this latter trade, in annealing, case-hardening, tempering, and the melting of soft metals, gas is pre-eminently suited; and the Sheffield United Gas Company have found a congenial opening in exploiting this field. Encouraged by the low price of Sheffield gas, and the enterprise of such appliance-makers as Messrs. Richmond and Co. (who have specially considered the needs of the local trades, and by much experimenting have reached successful types of plant), the metal workers of the town are largely replacing their old coal-heated furnaces by gas-heated ones. One can hardly yet say that the pall of smoke which is so typical of Sheffield—at least, its manufacturing portions—shows any very notable decrease; but this consummation is almost past hoping for. Still, these new uses for gas must claim a large share in such notable increases of output as that referred to by Mr. Morrison during the day.

The Sheffield Gas Company have laid themselves out to show what can be done by the use of town gas at ordinary pressures, and have not yet entered the field of high-pressure gas either for lighting or heating. So far the outcome has strikingly justified their decision; and all will watch with interest the development and results of the two policies—high and low pressure gas applied to metal working—as now associated with the cities of Birmingham and Sheffield. In the new furnace laboratory is shown a large range of low-pressure gas-furnaces as devised by the Richmond Gas Stove and Meter Company. On Saturday, these were all at full heat, and were explained patiently and in detail to the individual members by various representatives of the Warrington firm. The equipment and range of sizes are so complete that tests can be actually carried out here by firms who may want to assure themselves of the possibilities of the new appliances brought to their notice.

Among the more notable exhibits were: (1) A very large reverberatory furnace of new design for annealing and case-hardening. With simply natural draught, a temperature of 1300° C. is obtained. The row of burners are attached to one side; while the secondary air for them is taken in on the other side, and superheated by being brought across under the furnace-bottom. (2) A suite of similar smaller ovens, with varying gas consumption, so as to afford a choice of temperatures over a wide range; thus being especially suitable for dealing with high-speed steel and for steel with a high carbon content. (3) A twin muffle-furnace suitable for annealing high-speed milling cutters, for forming pottery glazes, &c. Here the preliminary soaking is done in the top furnace, where a heat of 800° C. is obtained by means of the waste heat from the lower chamber, and finally 1300° is reached in the lower portion. (4) An oil-tank in the floor for quenching the steel after hardening. (5) Soft metal-melting furnaces for ladle-work (lead, solder, &c.), taking ½ and 1½ cwt. of metal. (6) A gas and air blast oven-furnace, suitable for hardening high-speed steel. Natural draught furnaces were shown capable of doing the same work; but the blast type gives the advantage of rapidity of production. (7) A lead bath furnace working with natural draught, and reaching a temperature of 800° C., suitable for hardening files and small carbon-steel parts. These are then immersed in a brine bath. (8) Open tempering plates of different sizes for tempering and gauging the temperature attained by the colours shown on the metal. (9) An oil tempering bath—mainly for machine blades—where the temperature can be accurately gauged by thermometers. (10) A suite of furnaces for non-ferrous metals—*e.g.*, brass, copper, aluminium, admiralty metal, &c. These use an air-blast of 1 to 1½ lbs. to the square inch; and those shown were the 60 and 200 lb. pot sizes. (11) A small air-blast forge furnace for tangs of files and tools generally.

At the *soirée* at the Royal Society, held at Burlington House last Wednesday, Dr. S. F. Harmer, F.R.S., showed, among other biological and other exhibits, the polyzoa of water-works, in regard to which he will shortly publish a memoir. It appears that they may multiply to such an extent in unfiltered water that larger animals, worms, and even fish, like sticklebacks, find sufficient food in the mains, and, multiplying, stop them up. Several such cases, commonly ascribed to the growth of algæ, have recently been observed in British water-works.

VALUATION OF WATER-WORKS ON TRANSFER.

A Discussion.

In connection with the recent meeting of the Institution of Water Engineers at Wakefield, there was published in last week's "JOURNAL" (p. 736) a paper on the "Valuation of Water-Works Undertakings on Transfer to Municipal Authorities," which was contributed by Mr. E. J. Silcock, M.Inst.C.E., F.S.I., of Leeds. The following is a report of the discussion which took place after the reading of the paper.

The PRESIDENT (Mr. C. Clemesha Smith, of Wakefield) remarked that they had listened to a comprehensive paper; and the author had dealt with a subject which he thought had not been touched upon before in the proceedings of the Institution. It would afford them much food for thought, and he trusted also for discussion.

Mr. T. MOLYNEUX (Stockport) said the paper appeared to him to be so full of detail that it was difficult to add to it in any way. There was, however, just one point that the author mentioned, and dismissed rather shortly, which he (the speaker) would like to bring before the Institution, as it was of importance to many of the members individually. This was the question of compensation to directors and servants. Some of the members had been servants of undertakings transferred to local authorities. He knew of one case in which the servants of the company were protected by the directors through an arrangement that the corporation were to pay the sum of £5000 for compensation to the secretary, engineer, and other servants. The corporation paid the £5000; but at a meeting afterwards, one of the shareholders objected to the arrangement. The servants got nothing, except what they obtained through the goodwill of the directors, in spite of the fact that the corporation had handed over the sum named. The position taken up by the shareholder—who was a solicitor—was that this sum was an undisclosed amount. Though it had been paid for a specific purpose, with the knowledge of the directors, it in some way had not been disclosed. The shareholder proved right in his contention. Ultimately, he believed, the engineer got £200, the secretary about £1000, the collector about £1000, and the rest went into the pockets of the shareholders. Though Mr. Silcock dismissed this matter rather shortly in his paper, it was a point that might affect members personally; and it behoved them to be on the look-out if ever they were in a transfer.

Mr. H. ASHTON HILL (Birmingham) said that he desired to correct one thing in the paper. The author mentioned the South Staffordshire Water-Works Company in his table; but the figures as they stood were not quite accurate, and it might be as well to have them right. The yield on the "A" shares, which were 10 per cent., but upon which only 6½ per cent. was paid, was £4 4s. 5d., not £4 5s. 9d. Then, the Company had no 7½ per cent. stock. There was a 7 per cent. stock, on which 6½ per cent. was also paid; and the yield was £4 7s. 3d., instead of £4 8s. 9d. These little discrepancies did not detract from the value of the paper and of the general principles which had been enunciated by Mr. Silcock. He seemed to have got hold of the various cardinal points of a subject of this sort; and though he had only touched upon them generally, he no doubt could go into them at greater length. In his opening sentence, the author said it was the recognized practice of Parliament to favour the ownership and complete control of the public water supplies by local sanitary authorities. Perhaps this was all right. Of course, there was a little bit of jealousy between members who represented companies and those who represented local authorities. There was the best water, the best engineer, and all that; and some of them thought that companies could manage water-works much better than corporations. Each one was entitled to his own opinion; but he (the speaker) must say he was not so strong on this aspect of the question as he was formerly. As the result of larger experience, he was inclined to go with the author of the paper—with this limitation: He did not think that transferring a small water undertaking to a small local authority was a move in the right direction. To his mind, the direction in which this matter of the transfer of water undertakings should move was the one that had been already many times touched upon, and which had been mentioned by their President that day. He meant that the water supply would in the end probably become a Government matter, and that the question of watershed areas should be taken in hand, and large sections of the country should be administered by one body. This body, he thought, should be a public one. It really should be a water board representative of all the different interests. Nowadays everything seemed to tend in this direction. The question of town-planning schemes had come forward, where the necessity had been forced upon local authorities of seeing that the various jealousies existing between adjacent small bodies did not interfere with the proper laying out of the country in this respect. Then in the case of tramways, for instance, if a municipality wanted to lay a tramway, they went and bumped up against another authority; and with the different interests they might not be able to act for the good of the public. This sort of thing, at any rate with regard to water supply, ought to be eliminated. One wondered why many places in that district which were supplied by different bodies were not furnished with water by one authority—a course which might conduce to enormous economy and great efficiency. He could imagine their President managing such an undertaking. Of course, it would be bad for the different water engineers concerned; but they were now only considering the matter generally, and it did seem that the trend for the future would be that towns close together should be managed as one. This was the direction in which he expected the water supply of the country to proceed. He would commend the paper to the close attention of the members, because it evidently embraced all the features of a subject in which the author must be well versed.

Mr. C. H. PRIESTLEY (Cardiff) confessed that he was not in a position to criticize what the author had stated in his paper, but thought he might possibly give some little information in connection with his own city which would be of interest. In the case of Cardiff, on the acquisition of the water-works by the Corporation there was no arbitration. He saw Mr. Silcock assumed in every instance that it was a question of arbitration. It was in 1879 that the Cardiff Water-Works Company were bought out on an agreement between the Corporation and the Company. In that case the price paid was 25 years' purchase of the net annual value. He thought—and Mr. Silcock drew their attention very forcibly to this matter in his paper—that sufficient care was not given at the time to the point of the value of the works as they then were. It was easy to imagine the difference between the works as they were now and the works as they were at the time of purchase. In 1879, the capital was only something like £100,000; whereas the expenditure had now reached £1,500,000. It must have been evident to everyone who could foresee the probable growth of Cardiff that the Company would have had to expend very large sums of money to keep pace with the increasing requirements. He came on the scene very shortly after the purchase; and it was found that nearly everything had been neglected for years before. There was no provision whatever made by the Company for the future; and a very large expenditure was immediately necessary. This expenditure had been such that the revenue, though it had increased from £12,000 to over £75,000 per annum, had not kept pace with the requirements. They had at the present time—and he was afraid they would have for a considerable number of years to come—a rate-in-aid on the undertaking. This was his one experience; and he gave it as an example. There was just one other point he would like to mention; and he thought the author had drawn attention to it. This was the question of outside districts, in which respect they were in a rather peculiar position at Cardiff. In certain of their outside districts, which had been supplied since the undertaking came into the hands of the Corporation, they were enabled to charge under their Act of Parliament 25 per cent. extra on the amounts levied within the city. This fairly represented the average rate-in-aid which they had been paying in the city. There was, however, one district—a small town, with a population of about 17,000 or 18,000—in which the Corporation could only charge the same rate as within the city. The result was that in the district referred to the people were paying considerably less for their water than the inhabitants of the city, although the latter had the whole of the responsibility for the water supply. This appeared to be a very unjust thing. It had been suggested that they should get an Act to alter it; but nothing had yet been done in the matter.

Mr. ROBERT ASKWITH (Bishop Auckland) wished to call attention to one point that he thought had been omitted—namely, the taking into account of the risk that a shareholder had run in investing in a company when originally formed. There were some companies that had never paid respectable dividends upon the money invested, and shareholders for years had been getting a too small return. The companies that were generally bought up by the local authorities were those that had been successful; for the simple reason that their success had depended very largely upon the increase in the population of the district. The growth of the population had made the company successful, and had usually brought a more powerful local authority into being, and thus the purchase took place. But it must be remembered that the people who had put their money originally into the undertaking had run a risk; and they should be in some way compensated for having done so. Suppose a man invested his money in two water companies—and for the purpose of his illustration he would mention that there was a very small company at Thirsk, in Yorkshire, which had never paid reasonable dividends, and which had not been bought up, because the population had not increased. But assume that a man had, when it was originally formed, invested £1000 in the Thirsk Company, and also £1000 in another company that had been very successful. Why should he have the benefit of the success taken out of his hands, or, rather, why should he not have taken from him the risk he ran in both cases? The risk of the small company that had not succeeded remained with him, and he had lost the good investment in the other. He did not get anything for the risk he had run.

Mr. J. F. BEDFORD (Colne) referred to the statement by the author that, in dealing with the number of years' purchase, there were certain portions of a water-works that were either perishable or became obsolete, and which ultimately required to be replaced. Mr. Silcock said this element of value could be dealt with in one of two ways—by decreasing the number of years' purchase on the maintainable revenue, or by deducting from the maintainable revenue an annual sum to form a sinking fund which would provide the amount required to replace from time to time those parts of the undertaking which became worn out or obsolete. He remarked in the next paragraph that the same principle was also

applied in certain cases where supplementary works were required in order to improve either the quality or quantity of water. But in such cases the deduction was made from the capital sum, and not from the number of years' purchase. The author pointed out that under certain conditions it might be more advantageous to the company to keep the number of years' purchase high—thereby seeming to imply that either way would do. It was conceivable to his (the speaker's) mind that in different circumstances the two methods might make a distinct difference; and therefore he would like to ask Mr. Silcock whether he did not consider that it would be more desirable to work according to a definite plan as between capital and revenue expenditure.

Mr. Silcock, in replying to the discussion, said, with regard to the question raised by Mr. Molyneux, that the compensation of directors and officials was undoubtedly a very important point for consideration by the members of the Institution who happened to be in the fortunate, or unfortunate, position of being bought out. He said "fortunate" in some cases, because he knew of one or two instances in which the officials of water companies had been very glad to take a sum of money as compensation for their prospective income, and to embark upon a different line of business altogether. In other cases, of course, they preferred to be included in the staff taken over by the purchasing authority. But he thought that this course was open to certain objections, because there was not, perhaps, quite the same security of tenure with a corporation as there was with a company. At all events, there had been some instances known in which men had been taken over by local authorities, and after being a very short time in this employ their services had been dispensed with. As to the small discrepancies pointed out by Mr. Ashton Hill, it might be that the date would account for the variations referred to. The table given in the paper was taken from Stock Exchange quotations in 1911. However, the variation did not vitiate the principle, but merely emphasized the care one must exercise in the illustration of the principle. He agreed—and said so in the paper—that there were undoubtedly many cases where water boards did present a difficulty. There was often a good deal of jealousy between local authorities; and sometimes there was difficulty in arranging these prejudices in the formation of water boards to deal with the supply of a district which covered any considerable quantity of ground. In these circumstances, undoubtedly a company could deal with the subject with a freer hand, and therefore more efficiently, than a municipal authority; but broadly speaking he thought he was in favour of the water supply being in the possession of the local authority. Of course, he quite recognized, as pointed out by Mr. Priestley, that there was no necessity to have an arbitration to determine the price to be paid on a transfer. There were many instances of water undertakings being purchased by agreement. There was Cardiff, as they had just learned; and he believed the Stockport Company also was bought without an arbitration. It was, however, quite possible that, if an arbitration had been held in both these cases, it might have been advantageous to the local authority. Certainly, the figures quoted by Mr. Priestley would lead one to suspect that the number of years' purchase—namely, 25—which was used for capitalizing Cardiff, was rather on the high side. With regard to the question of the risk of the shareholder in one company which paid and another which did not pay, he really did not think there was any injustice, when the matter came to be considered fairly. If a man invested in a company which did not pay, and it was purchased, he was bought out on the basis that it did not pay; and if he continued to hold it would probably not pay him in the future any better than in the past. Therefore he did not suffer any disadvantage. On the other hand, if a man was fortunate enough to invest in a company which paid a good dividend, then he was, on purchase, compensated on this basis, and he, again, did not suffer any injustice. Therefore it seemed to him that the point raised was met by the arbitration procedure.

Mr. Askwith: My point is that a man who has been unfortunate in his investment is not bought out, but is left with a bad bargain. He loses on one investment, and is only bought out on equal terms in the other.

Mr. Silcock said he saw the point, and was afraid it was the "fortune of war." When a man put his money into any sort of speculation, he had to take the risk of whether or not it was going to be successful. But whether he was fortunate or unfortunate did not govern the question of whether a local authority should be entitled to purchase his holding on equitable terms. Mr. Bedford's criticism, he thought, was more a matter of words than anything else. If he (Mr. Silcock) had, as he ought to have done, put the word "usually" in and said, in the sentence last referred to by Mr. Bedford, "the deduction is usually made from the capital sum, and not from the years' purchase," perhaps the difficulty would have disappeared. At all events, the point was this: If they knew definitely what sum was required in order to make works more perfect, they were entitled, if representing the vendors, to say: "By the expenditure of £10,000, we can make the undertaking perfect, and therefore we have a right to be compensated on the basis of a perfect undertaking, less £10,000." This would probably yield a better result to the vendor than if it was taken as being only a second-rate undertaking, and that the owners ought consequently not to be compensated on the basis of such a high number of years' purchase. It depended probably upon the side on which one was engaged which view he put forward.

ESTIMATION OF PHENOL IN CRUDE CARBOLIC ACID AND TAR OILS.

By John Morris Weiss, B.S., B.A.

[A Communication to the Franklin Institute of Philadelphia.]

A problem which is occasionally presented to the chemist engaged in the examination of various tar products is the determination of actual phenol (C_6H_5OH) in the substance under consideration. Usually all that is required is the estimation of total phenols—generally called "tar acids." These tar acids consist of a complex mixture of phenol, cresol, and various higher homologues; and their quantitative estimation *in toto* is always based on their common chemical property of solubility in a solution of caustic alkali. But sometimes it is necessary to proceed further, and ascertain how much of these tar acids is real phenol.

At present, so far as the writer has been able to learn, there is in the literature no satisfactory solution of this problem. Many tests for the qualitative distinction of phenol, cresol, and the higher homologous oxygenated aromatic hydrocarbons have been proposed. Some of these are of very doubtful value, even qualitatively; but none are all susceptible of even approximate quantitative application. The only real attempt in this field was that of Charles Lowe [see Lunge's "Coal Tar and Ammonia," Fourth Edition, pp. 608-9]. This is proposed for crude carbolic acid, and is more a specification for material than a method of analysis. Briefly, it consists in plain distillation in a retort, with no attempt at fractionation, and subsequent determination of the melting-point of an arbitrary fraction. This fraction is a definite volume per cent. after the removal of the water. The percentage of phenol is determined by adjusting a mixture of phenol and cresol (a mixture of the three isomers) to have the same melting-point. This is a method evidently only applicable when the percentage of phenol is large, and when there is no disturbing influence of higher homologues.

The writer, in attacking this problem, decided that chemical properties would be inferior to physical properties as a means of distinction, in view of the fact that the material sought existed in mixture with bodies very closely related chemically to it. To separate phenol from all bodies except the next higher homologues, the cresols, is a comparatively simple task, and one which can be accomplished in a convenient and easy manner. Further, if the physical properties of a large number of varying mixtures of phenol and cresols are known, the estimation of the phenol is possible—the exactness varying with the number of such known mixtures. This really is the gist of the work undertaken by the writer; and the practical results of the investigation are presented in this paper.

The work was complicated by the fact that the three isomeric cresols exist with varying physical properties, and the possibilities of mixtures with four variables are enormous. This phase of the question, as will be seen later, was considerably simplified.

As a preface, it may be well to give the physical properties of phenol and the cresols, as taken from Van Nostrand's "Chemical Annual:"

	Melting Point.	Boiling Point.	Specific Gravity.
Phenol	42·5° to 43° C.	182·6°	1·0677
o Cresol	30°	191°	1·0511
m Cresol	3° to 4°	202°	1·0390
p Cresol	36°	202°	1·0390

The specific gravities are given for the cresols at 15°/15° and for phenol at 35°/35°. Beilstein gives the following figures:

	Melting Point.	Boiling Point.	Specific Gravity. at 0° C.
Phenol	42·5° to 43° C.	178·5° to 184·1°	1·0906
o Cresol	30°	190·8°	1·0578
m Cresol	3°	202·8°	1·0498
p Cresol	36°	201·8°	1·0522

As may be seen, the specific gravities and boiling points of *m* and *p* cresols are quite close together; and these two always occur together in commercial mixtures. Therefore, to simplify matters, a mixture of these was used instead of the pure separate materials—thereby reducing the variables to be considered to three. The *m* and *p* cresols cannot be separated by physical means; and to prepare them pure is a very extensive and difficult task. As to the accuracy of the above figures given by various authorities for the physical constants of these substances, the writer feels that in many cases they are inaccurate, and he will take up this phase of the subject later.

The phenol used was prepared synthetically from pure benzene—the *o* cresol by fractional extraction of a mixture of cresol with caustic soda solution, subsequent crystallization from petroleum ether, and final fractional distillation. The mixture of *m* and *p* cresol was separated by a very careful and efficient

fractionation of a fraction of but 2 or 3 gallons taken from a works still handling large charges. The tests of these materials are given below:

	Phenol.	*o* Cresol.	Mixture of *m* and *p* Cresol.
Solidifying point . .	40·5° C.	27·75°	Below −10° C.
Specific gravity 25°/25°		1·0429	1·0313
Boiling point range .	179° first drop	189° first drop	198° first drop
	180° 1 p. ct.	190° 19 p. ct.	199° 2 p. ct.
	181° 92 ,,	191° 93 ,,	200° 6 ,,
	182° 100 ,,	192° 100 ,,	201° 81 ,,
			202° 100 ,,

To obtain some idea of the purity of these substances, the effect of 5 per cent. of *o* cresol or the *m*—*p* cresol on the phenol boiling point was determined, as follows:

95 % Phenol, 5 % *o* Cresol.	95 % Phenol, 5 % *m* − *p* Cresol.
177° first drop	178° first drop
178° 2 per cent.	179° 7 per cent.
179° 4 ,,	180° 10 ,,
180° 9 ,,	181° 23 ,,
181° 88 ,,	182° 85 ,,
182° 96 ,,	183° 93 ,,
184° 100 ,,	185° 97 ,,
	190° 100 ,,

Similarly, *o* cresol with 5 per cent. phenol addition had a range in boiling point of from 186° to 192° C. The method for taking boiling-point range was a distillation of 100 c.c. in a Jena flask protected by an asbestos ring and connected to a 24-inch condenser. Naturally, there is a certain lag of the thermometer at the start, and a slight superheating at the end which tends to enlarge the range, even of a pure substance. The presence of a trace of water, hard to avoid in such hygroscopic substances, also causes a slight amount of material to distil below its true boiling point. Of the phenol, practically 90 per cent. boiled between 180° and 180·5°, and no fraction could be obtained having a higher solidifying point than 40·5° C.—no matter how many times it was distilled. The same was true of the ortho-cresol on distillation—no fraction could be obtained with a solidifying point over 27·75° C. These solidifying points were taken on a large quantity of material with the thermometer in the liquid. The thermometer was a Jena glass normal thermometer that has been checked by the United States Bureau of Standards. The writer therefore considered his materials practically absolute, and deemed that the high figures given by earlier investigators as to melting point were inaccurate either because of erroneous thermometers or from the use of too small quantities of material.

A large number of mixtures were made with the above materials—using 0, 5, 10, 20, 30, 40, 50, 60, 70, 80, 90, and 95 per cent. phenol; and for each percentage of phenol eleven variations of the proportions of *o* and *m*—*p* cresols were used, making in all 132 mixtures. The boiling-point range, specific gravity, and solidifying point of all these mixtures were then determined.

For the purposes of this paper it is not necessary to detail the whole of the figures obtained on these mixtures, but only those which would be of practical value to the worker. It was found that for all but unusual cases the determinations of solidifying point and specific gravity were enough to characterize the mixtures as to their percentage of phenol, and that a determination of boiling-point range was superfluous.

The procedure for determining the percentage of phenol in a crude carbolic acid or a tar oil should be as follows: A definite volume of material should be taken, sufficient to give 300 c.c. of total phenols (tar acids). This should then be treated with sufficient caustic soda solution to dissolve all the tar acids. The solution of acids in soda is carefully separated from the neutral hydrocarbons, and then steam-distilled until no oil is present in the distillate. This ensures the removal of all material not tar acids. The soda solution is then cooled, brought into a separatory funnel, and acidified with 40° Baumé sulphuric acid. The mass is allowed to settle, and the lower layer of sodium sulphate discarded. The upper layer of phenols is brought into a distilling flask with a Hempel tube, and distilled up to 170° C. vapour temperature. This removes water; but a small amount of acid is carried over in the process. This latter is separated from the water and returned to the flask. The distillation is then continued, and two fractions taken off—the first up to 190° C., and the second from 190° C. to 202° C. This second fraction is redistilled, taking all up to 197° C., and is added to the 190° fraction obtained in the first distillation. This combined fraction contains all the phenol and none of the homologues above cresol, and is tested for solidifying point and specific gravity.

The solidifying point is taken on about 50 c.c. in a test-tube, with the thermometer in the liquid, and cooling until separation of crystals occurs. At this point there is a constant temperature for a short period which is taken as the solidifying point. If the material supercools, crystallization may be brought about by the addition of a minute crystal of phenol. In this case the temperature rises as the crystals separate, and the highest point reached is taken as the solidifying point. The specific gravity should be taken on a Westphal balance at 25° C. and referred to water at the same temperature.

These figures are compared with those given below; the percentage of phenol noted; and the result figured back to the original material. In considering these figures, it should be remembered that *o* cresol tends to raise simultaneously both the specific gravity and the melting point of a mixture; and therefore up to a certain stage with increase of melting point the gravities corresponding to the same percentage of phenol also increase.

Various mixtures which may occur as a result of the above procedure are given in a rough classification.

Solidifying Point Below 0° C.

Specific Gravity $\frac{25}{25}$.	Per Cent. Phenol.
up to 1·032	0
1·035	5
1·040	10
1·043	20
1·047	30
1·049	40

Mixtures above 40 per cent. phenol have a solidifying point over 0° C.

Solidifying Point 0–5° C.

Specific Gravity $\frac{25}{25}$.	Per Cent. Phenol.
up to 1·038	0
1·040	5
1·042	10
1·045	20
1·048	30
1·052	40

Solidifying Point 5–10° C.

Specific Gravity $\frac{25}{25}$.	Per Cent. Phenol.
1·039	0
1·041	5
1·043	10
1·047	20
1·050	30
1·053	40
1·055	50

Solidifying Point 10–15° C.

Specific Gravity $\frac{25}{25}$.	Per Cent. Phenol.
1·040	0
1·042	5
1·044	10
1·048	20
1·051	30
1·054	40
1·057	50

Solidifying Point 15–23° C.

Specific Gravity $\frac{25}{25}$.	Per Cent. Phenol.
1·041	0
1·043	5
1·045	10
1·048	20
1·052	30
1·055	40
1·058	50
1·061	60

Solidifying Points above 23° C.

Solidifying point ..	23·5° ..	Phenol 70 per cent.
Solidifying point ..	29·5° ..	Phenol 80 per cent.
Solidifying point ..	32·75° ..	Phenol 85 per cent.
Solidifying point ..	35·5° ..	Phenol 90 per cent.
Solidifying point ..	37·75° ..	Phenol 95 per cent.
Solidifying point ..	40·5° ..	Phenol 100 per cent.

With solidifying points above 23° C., it was found that the variations in percentage of the cresols among themselves did not affect the solidifying point for any particular percentage of phenol.

Some mixtures would not be covered correctly by the above tables. For example, a mixture of 20 per cent. phenol and 80 per cent. *m*–*p* cresol melts below 0° and has a gravity of 1·040. This would indicate, as above, only 10 per cent. phenol. But such a mixture could never occur in a fraction obtained from natural materials; and therefore it is unnecessary, for practical analysis, to cover this ground. If it were necessary, the boiling points would be distinguishing; but to introduce these constants would make complications, and would not be of practical value for the purposes this paper is designed to cover.

In using these tables, the worker must exercise some judgment, as, if a solidifying point were barely over 0° C. and the specific gravity were 1·040 at 25° C., the percentage of phenol would be more than 5 per cent. and less than 10 per cent., and about 7·5 per cent. should be taken. Conversely, near the upper end of a range of solidifying points the gravity would indicate slightly less phenol than the figure given. If the figures are used intelligently and with real insight into their meaning, an estimation on the fraction within 2·5 per cent. of the true value should be readily obtained. Depending upon the total amount of tar acids in the original material, the results on the basis of the latter should be accurate between 0·2 per cent. and 1·5 per cent., and this is sufficiently close for all ordinary purposes.

Mr. Dugald Clerk on Internal Combustion Engines.

It has already been announced that the Committee of the Junior Institution of Engineers have arranged that the second "Gustave Canet" lecture will be delivered on the 30th inst. by Mr. Dugald Clerk, D.Sc., F.R.S. The subject chosen—"The Working Fluid of Internal Combustion Engines"—is one upon which the lecturer is particularly well qualified to speak; in fact, it is doubtful whether a greater authority on the internal-combustion engine is to be found. His book upon the subject has been the standard work in this country for many years; and the new edition, recently published, adds to the author's reputation.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Hygienic and Heating Efficiencies of Gas-Fires.

SIR,—We are more than ordinarily interested in the correspondence which has recently appeared in your columns under the above heading, in view of our position as pioneers in gas-fire construction.

We regard it as absolutely essential that the whole of the products of combustion from a gas-fire should be carried out of the room and up the chimney specifically provided for that and other purposes. When it is remembered that at the present time many fires are fixed without the direct attachment of a length of flue-pipe (an additional cost of fixing), it is clear that a fire to be hygienically perfect should at least effect the discharge of the whole of its products into the chimney without such attachment.

The old complaint against gas-fires, that they "made rooms feel stuffy," was certainly justified in view of the frequent insufficient ventilation by the chimney, although, perhaps, all the products of combustion were removed by the flue. It was, and is, common practice when fixing a gas-fire to completely close up the chimney opening, with the exception of the space required to receive the flue nozzle. It should therefore be the aim in gas-fire construction to provide a correctly shaped brick, with a direct and unrestricted outlet of ample dimensions, and so disposed as to ensure the complete discharge up the chimney of the products from the fire *plus* additional air for ventilation. This, we believe, can be accomplished without materially decreasing the radiant efficiency of the fire.

We congratulate Messrs. Davis on the attitude they have adopted in this matter, insisting as they do on the importance of hygienic, as well as radiant, efficiency. They are engaged in a crusade which should receive the support of all gas-stove makers. We must, however, qualify the credit due to them by pointing out that our series of fires for the season 1911 were all constructed with the pocketless hood and large flue outlet, with the result that they have satisfactorily passed the "shadowgraph" test.

For the sake of historical accuracy, and in justice to ourselves, we feel that the controversy which is proceeding in your columns should not entirely obliterate from public notice the fact that *all* the distinguishing features in up-to-date gas-fire construction, among which we may mention the single row of upright fuel, double length fuel, flames burning inside the fuel, the use of a gas and air adjuster, the pocketless hood, the duplex burner, &c.—the whole of which are now universally adopted—*originated with, and were popularized by, us.* It is surprising to us that our competitors frequently claim to be the originators of these improvements; but it is a source of satisfaction that, for the general welfare of the industry, makers of gas-fires have followed our lead.

WILSONS AND MATHIESONS, LIMITED,
Leeds, June 13, 1913. per JAMES W. WILSON.

Scientific Carbonization.

SIR,—At the close of last year, Mr. Toogood had given to him "tangible evidence" that his claims in his 1908 patent specification were all accomplished in practice so far back as the years 1900-02 (as records show), and that in the last-named year a patent was obtained substantially covering those claims which Mr. Toogood now asks the readers of the "JOURNAL" to believe—in his own words—"which I regard originated by me."

The least important question to answer would be how little and few of these particular claims Mr. Toogood has left to himself—especially if the law of patents had it to decide.

It is quite immaterial, and of no consequence, what any gas engineer said in 1911, as affecting the granting of a patent in 1902, and another in 1908, or what the former patent covers in the claims made for the patent granted six years later.

For the want of a competent Board of Examiners at the Patent Office, original inventors and inventions have suffered much, as it has always been permissible for a second so-called inventor to obtain a patent for almost precisely the same invention right over the head of the "first and true inventor thereof." And here is a case in point.

To uphold the rights of a patent one must get inside the Law Courts —a process of taking your "grist to mill."

These repeated attempts made by Mr. Toogood—with convenient intervals of silence between—to deprive the pioneers of their just and recognized claims in vertical retort carbonization, and the records of work done nearly ten years ago, certainly do not show the wholesome spirit of giving "honour to whom honour is due."

To finally set at rest delusions as to proprietary of claims, I venture to give (as one instance only) the words contained in Mr. Toogood's 1908 patent, No. 20,851, with also the words in the claims of the patent No. 12,552 of 1902, granted to Messrs. Settle and Padfield, of Exeter. No. 12,552 of 1902.

Messrs. Settle and Padfield claimed:

(1) Introducing the coal into the top of the retort in small quantities at regular intervals.

(2) The mode of carbonizing coal in vertical retorts consisting in introducing coal into the retort in such a manner that the coal will fall towards the walls of the retort.

(3) A vertically reciprocating coal-measuring device in the cylinder; such device being so formed as to direct the falling coal outwards towards the walls of the retort.

Mr. Toogood's patent, No. 20,851 of 1908, claimed:

A method of charging consisting in feeding a relatively thin stream of coal adjacent to the side of the retort.

Gas engineers are now more interested in the results being obtained by the present-day systems of vertical retorts.

It was not the desire to discuss with Mr. Toogood priority of patents or claims so much that I appealed to him in my letter of May 24 last to be quick and give some results of the system he has taken so great a part in; and this appeal arose out of some results supplied to me, and recently obtained under ordinary working conditions, by Dessau plants in two large works in this country.

The task is no light one in dealing with over 10,000 tons of coal, as the figures before me show. The volume obtained per ton by these two Dessau installations I find works out at over 14,800 cubic feet of gas per ton with an average of 15·57-candle power—tested by the No. 2 burner, and an average calorific value of 500 B.Th.U. net. A striking figure in the composition of the gas is that the hydrocarbon content is 30·6 per cent. of the whole volume.

I was anxious to see if Mr. Toogood could give a better figure to add to some carbonizing statistics I am at present preparing for publication.

June 12, 1913. CONSISTENCY.

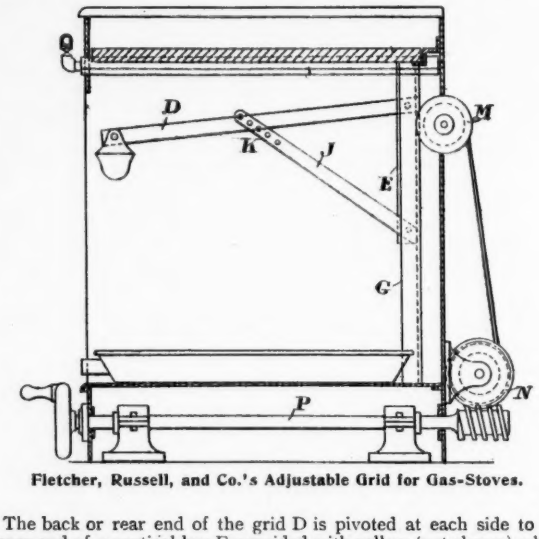
REGISTER OF PATENTS.

Gas Cooking Ranges.

FLETCHER, RUSSELL, AND CO., LIMITED, and FLETCHER, T. W., of Warrington.

No. 12,650; May 29, 1912.

This invention relates to cooking ranges provided with grids or grills which are adjustable as to height or level below or above the gas-burners or fire and also adjustable as to inclination.



Fletcher, Russell, and Co.'s Adjustable Grid for Gas-Stoves.

The back or rear end of the grid D is pivoted at each side to the upper end of a vertical bar E provided with rollers (not shown) which engage angle-iron or channel-iron guide standards G. The grid is supported at the desired inclination by diagonal stays J pivoted to the bars and adjustably connected to the sides of the grid at K. Near the top of the stove is mounted a pulley M, and at the bottom of the frame is a pulley fitted with a cord or chain connected to the centre of the back of the grid. A worm-wheel N connected to the pulley is actuated by a worm on a shaft P extending to the front and operated by a hand wheel. Thus the grid can be raised and lowered to any height required, "so that the heat may be regulated and the food placed on or removed from the grid with facility." The inclination of the grid may be varied by adjusting the connection of the stays J to the grid at K.

Methods of Mining Coal, Converting it into Gas, and then Conveying the Gas from the Mine.

HOADLEY, J. H., of Manhattan, New York.

No. 14,494; June 20, 1912.

This invention "embraces a general system of mining, transporting, converting, and utilizing coal, to the end that large economies are introduced at every stage of the process, which . . . constitutes a continuity of procedure beginning at the separation of the coal from its bed and terminating at its utilization in the form of combustion gas and the various bye-products."

The method "can be carried into effect" by the means shown in a series of six sheets of drawings accompanying the specification. The patentee says he does not, however, limit himself to this particular arrangement, but may vary the details in several ways, so long as the continuous and automatic method as herein claimed is carried into practical operation.

The specific claims here alluded to are: 1. The improved method of mining coal, converting it into gas, and then conveying the gas from the mine, which consists in comminuting the coal in the act of removing it from the seam, introducing the powdered coal into a producer, and making combustion gas, and finally conveying the gas out of the mine through suitable pipes. 2. The comminuting of the coal in the act of taking it from the seam, drawing the powdered coal by continuously moving fluid agencies from the working face into separating devices, automatically conveying it thence into a gas producer, and finally drawing off the resultant gas out of the mine through suitable pipes. 3. A continuous method of comminuting coal as it is taken from the seam, drawing it from the working face by the combined agencies of air and water, removing quantities of such air and water as will present the right proportion for the next following step, introducing the

resultant mixture into a gas producer, and then conveying the resultant gas out of the mine to the utilization point. 4. A method of comminuting coal as it is cut from the seam, transporting and wetting the product automatically, heating it, and discharging the resultant steam and partially dried product through different channels into a gas producer, and finally conveying the resultant gas out of the mine.

Obtaining Gas from Peat, Oil, Sawdust, &c.

OLIGNY, J. D., of Montreal, Canada.

No. 12,562; May 28, 1912.

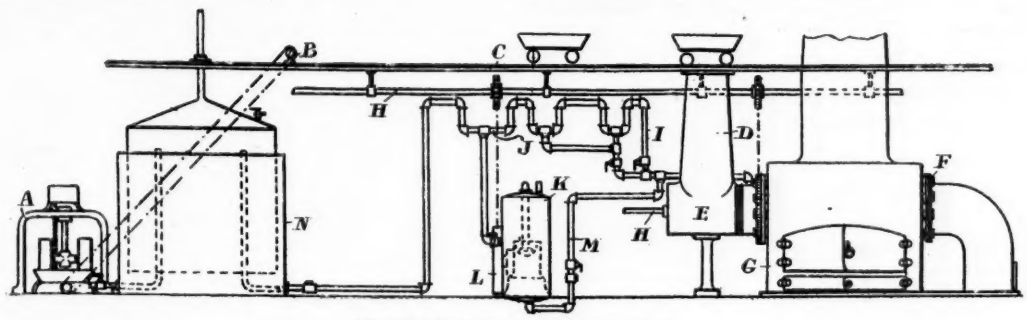
The production of gas from peat, oil, sawdust, &c., is intended by the patentee to be so carried out "as to make it commercially possible to provide such gases to the public for consumption, to furnish a reliable and very efficient lighting and heating gas, and a gas for power purposes, and generally to utilize, to the ultimate benefit of the public at large, material which is now practically waste matter."

The invention consists in heating the substance in a rotary retort, then withdrawing the gas generated from the retort, condensing-out the heavier condensates (which are returned to the outlet pipe or the retort by gravity), then condensing-out the lighter condensates, dropping them into a tank containing air above atmospheric pressure, then opening an outlet pipe so that the lighter condensates are blown at suitable intervals into the retort accompanied by the air, and finally passing the gas into a holder.

The various steps will, it is said, be "arranged and limited" according to the conditions under which the gas is produced. In the first place, the peat in its wet condition is placed in a crusher indicated A. Here it is sprinkled with petroleum, and then dropped on to an endless carrier B and transported to an elevated platform C. The peat in this condition is a "pulpy mass," as its original fibrous nature has been destroyed through the crushing, which "has the effect of releasing the water and spreading it throughout the substance, which is composed of decayed vegetable matter, water, and petroleum, or other carbonaceous matter." The peat on the elevated platform is transported to the shoot D, and from there drops by gravity into the feed chamber E, and from this chamber it is from time to time pushed into the retort F, during the operation of the plant, without opening the retort.

The retort is heated by the furnace G, and during the operation of distillation, it is rotated by the shaft H. The gas outlet pipe leads to the condenser I. Thus the heavier condensates (such as tar) are separated from the main volume, and by gravity return to the outlet pipe G or retort. Other condensates return through pipes connected to the outlet pipe.

Another condenser J is arranged a short distance further on in the pipe G; and the volume of gas relieved of the heavier condensates here parts with the lighter condensates—such as paraffin, alcohol, and other bye-products—and these drip by gravity into the tank K. The air in this tank is preferably maintained at the required pressure by a pump L operatively connected to the shaft. At the bottom the tank has an outlet through which the lighter condensates are blown at suitable intervals into the pipe M and back into the retort or to the outlet pipe adjacent to the retort.



Oligny's Plant for Carbonizing Peat, &c.

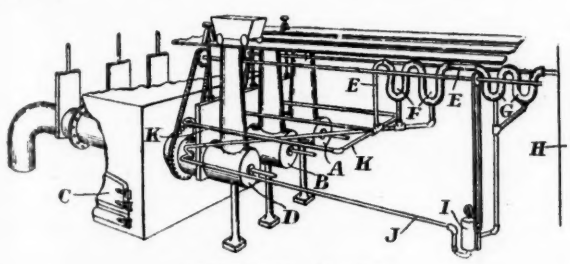
It will thus be seen that "as the process proceeds, the original substance is being continuously subjected to heat until the separation is complete—that is, into gas and coke, the former being greatly increased in volume by the air which is sent into the retort during distillation at each blast on returning the lighter condensates. This air becomes carburetted, particularly in contact with the heavier condensates, and mixes with the gas in the retort and flows out with the outflowing gas." The gas continuously flows into the holder N, though "in some instances it may be advisable to pass it through an iron oxide purifier immediately preceding its entrance to the holder, and thus relieve it of any trace of sulphur."

Obtaining Gas from Peat, Oil, Sawdust, &c.

OLIGNY, J. D., of Montreal, Canada.

No. 12,563; May 28, 1912.

This invention consists in treating peat with heat, coincidently treating a liquid hydrocarbon with heat, passing the gases thus formed through common condensers, condensing out the condensible parts of the gas, returning these condensates to the liquid hydrocarbon container, again reheating these condensates, and passing the fixed gas to a holder.



Oligny's Peat-Gas Plant.

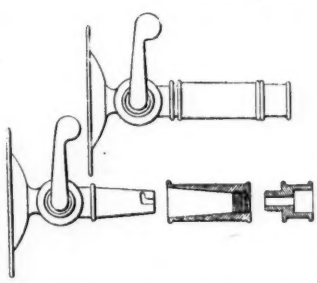
The peat, in its natural state, is loaded into retorts A B over a suitable furnace C, and preferably arranged to rotate. The retort D is loaded with crude petroleum oil. The gas flows outwardly from the retorts A B through pipes meeting the general outflow pipe E, which leads to the condenser F, and, further on, to the condenser G, finally entering the holder H.

The gas from the retorts A B is condensed first in F, and the heavier condensates drop through a pipe into the retort D. The gas flowing outwardly in the pipe E is further condensed in G, and the lighter condensates drop by gravity into the tank I which contains compressed air. The lighter condensates are blown through the bottom of the tank into the pipe J and on into the retort D. The gas being generated here from the crude oil, and the condensates which have been returned, are also treated by heat in this same retort, and consequently it is a mixed gas, increased in volume by air, which flows out through the pipe K to the condensers F G, undergoing further condensing if required—the condensates returning to the retort D.

Connectors for Gas-Pipes.

SMITH, H. E., of Bush Hill Park, Middlesex.

No. 26,799; Nov. 21, 1912.



Smith's Flexible Gas-Pipe Connectors.

In this connector for gas or water pipes the pipe section to be connected has a conical exterior and fits the other which has a conical interior, while the two sections are drawn together by a pin on one section engaging in a slot on the other slightly inclined to the end surface of the pipe. The connector is said to be especially adapted for joining on flexible piping for making temporary gas installations, for supplying table lamps.

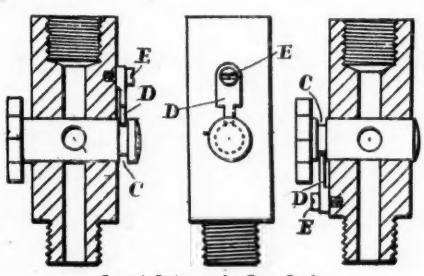
An elevation of the complete device fitted together, and its separate parts (in cross section) are given, and do not need further explanation

Gas-Cocks.

STANISLAUS JULIAN, Count OSTROROG, of Chelsea, S.W.

No. 28,216; Dec. 6, 1912.

This invention consists of an improved lug or attachment to be applied to a parallel cock which shall engage a groove in it and thereby, on the one hand, retain the cock in its working position with a minimum of friction, and at the same time leave it free to be withdrawn for cleaning purposes by simply moving the lug out of engagement with the groove in the cock.



Count Ostrorog's Gas-Cock.

The illustration shows a cock with the invention applied to it, with the lug at the back, and (as an alternative) applied to the front of the cock.

The cock is provided at or near one end with a groove C, into which

is adapted to engage a lug D, hinged or fixed at E by a screw. The lug is preferably reduced in area at the part which engages the groove, in order to afford as little surface as possible in contact; and the lug engages freely in the groove, allowing a certain amount of lateral play to the cock. Thus the cock is retained in place with little or no friction; and if it is desired to remove it for inspection or cleaning, this can be done by simply moving the lug upon its pivot out of engagement with the groove.

Where the lug is applied to the front end of the cock, the construction is similar to that described.

Treatment of Coal, &c., in Vertical Retorts.

WADDELL, A., of Dunfermline.

No. 21,991; Sept. 27, 1912.

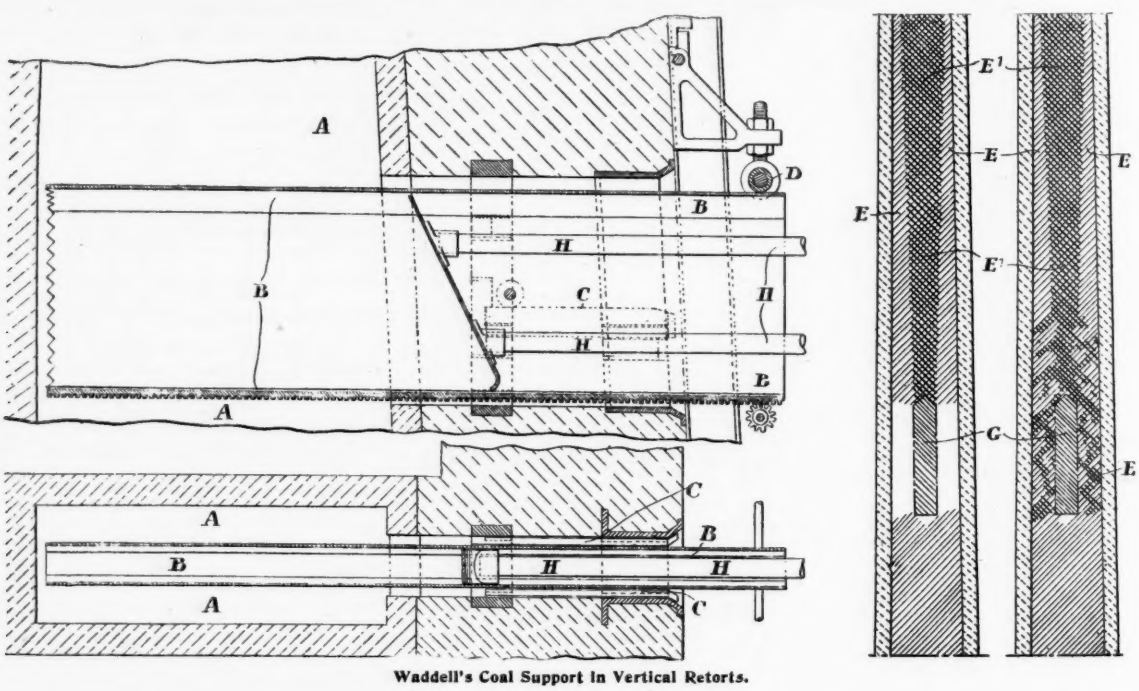
The patentee points out that, in carbonizing coal, &c., in vertical retorts, the heat applied to the outside of the retort "takes a comparatively long time to carbonize the whole of the mass within the retort—the time varying according to the thickness of the mass." His invention has for its object "to reduce the distance necessary for the heat to travel towards the less carbonized part of the mass by causing that part of the mass to come nearer to the hot retort walls, also to utilize the comparatively highly heated portion to assist in carbonizing the lesser heated material by causing these to commingle." Means are provided for the temporary support (at suitable positions) of sections of the usual uncarbonized or partly carbonized centre or core of material. This supporting means is insertable and withdrawable while the retort is in use, and "is provided with the object that it may be inserted to support or envelope the centre or core, while a carbonized portion of the mass at the bottom of the retort is withdrawn."

An example as applied to retorts rectangular in plan is shown in vertical and horizontal section with the supporting device in its acting position; also transverse vertical sections (to a reduced scale) showing diagrammatically how the material within the retort descends when the supporting device is in position and a carbonized portion of the mass at the bottom of the retort is withdrawn.

The retort A is rectangular in plan; and an aperture is formed in the retort wall at any desired level to permit of the insertion into the retort of a core-supporting device B. This is of metal, of open-ended box form; its upper surface being of inverted V-shape and the lower edges of each side being turned inwards to form flanges to which is secured a rack forming the bottom of the box. When inserted, it extends across the retort in the direction of its greater horizontal dimension. It is of less width than the retort, so that there are spaces between its sides and the walls of the retort. The device is supported by rollers, one on each of its sides, running on rails C carried at their ends by metal liners extending round parts of the aperture in the retort wall, and also by a flanged roller D bearing on its upper surface, and a pinion gearing with the rack. The pinion is on a shaft which may be rotated either by hand or power; and when rotated, as the pinion gears with the rack, the core supporting device can be either inserted or withdrawn. The forward edge of the device is serrated, "to facilitate its cutting its way through the mass of material within the retort."

What takes place in the process of carbonization according to this invention is said to be shown diagrammatically; the carbonized or highly-heated portion of the mass being shown by single hatched lines E, while the core or less carbonized part of the mass is represented by cross hatched lines E^1.

When a carbonized portion of the mass at the bottom of the retort is to be withdrawn, the device B is first inserted, as described, and being of open-ended box-form, on entering the retort, it takes within it and



Waddell's Coal Support in Vertical Retorts.

holds up a section of the uncarbonized or partly carbonized core of material—this section being shown at G.

The device B being in position within the retort, when a withdrawal takes place the material within the retort, up to the level of the top of the device, first falls a distance equivalent to the amount drawn off at the bottom—the material between the support B and the retort walls falling beneath the support and momentarily leaving a space as shown. This space is, however, at once filled by the descent of the material above the support—"the comparatively hot and the cooler portions commingling when so falling." Part of the less carbonized central core of the mass "is thus not only brought nearer to the hot retort walls, but as it is also commingled with the comparatively highly heated portion, and part of that portion is thrown nearer the centre of the mass in its descent, the carbonization of the whole mass is thereby facilitated."

APPLICATIONS FOR LETTERS PATENT.

12,751.—MAUDE, J., "Suction-gas plant." June 2.
12,778.—KILCHMANN, E., "Extinguishing lamps." June 2.
12,796.—POTTER, W. G., "Burners and lamps." June 2.
12,833.—MADSEN, C. J. H., "Utilization of exhausted gas purifying materials." June 2.
12,880.—M'DOUGALL, I. & S., and HOWLES, F., "Treatment of tar." June 4.
12,891.—KENT-JOHNSTON, A. G., "Distance gas lighting." June 4.
12,926.—WATKINSON, J. G.,, and FLETCHER. P. H., "Inverted burners." June 4.
12,940.—KOHNSTAM, J., "Acetylene generators." June 4.
12,968.—DORMAND, H., "Gas-producer." June 4.
12,976.—BIRD, H., and HAYTER, G., "Drawing and charging gas-retorts." June 4.
12,979.—JOHNSON, J. Y., "Production of ammonium sulphate." A communication from the Badische Aniline und Soda Fabrik. June 4.
12,989 —WINTERFLOOD, J., "Geysers." June 4.
13,039.—FAUVEL, E., "Acetylene generator." June 5.
13,104.—STEPHENSON, J., "Distillation of coal." June 5.
13,121.—DIXON, L., "Gas and air adjusters." June 6.
13,140-1.—WESTWOOD, F., and COOKE, H. S., "Lighting lamps." June 6.
13,155.—SMITH, E. W., "Coin boxes for meters." June 6.
13,184.—FORWOOD, G. F., and ROSTIN, H. P., "Gas-igniter." June 6.
13,226.—GWILT, G., "Generating acetylene." June 7.
13,229.—EDWARDS, W. C., and PHILLIPS, D., "Attachments to burners." June 7.
13,252.—RITGHIE, T., and BONE, C. S., "Acetylene generator." June 7.
13,253.—FROST, A. C , and WRIGHT, A. C., "Dry meters." June 7.

Guildford Public Lighting.—A lighting contract for £2000 annually has been entered into between the Guildford Gas Company and Town Council; the arrangement being that the lamps shall be 70-candle power incandescent, instead of 54-candle power. A saving of £134 per annum will be effected by the change.

Humphrey Pump Company, Limited.—This Company was registered on the 6th inst. with a capital of £200,000 in £1 shares (50,000 being 7 per cent. preference), to take over the business of the Pump and Power Company, Limited, of 38, Victoria Street, S.W.; to carry on the business of manufacturers of, contractors for, and dealers in, pumping, power, and other plant; and to adopt an agreement with the above-named Company and Mr. H. A. Humphrey. The offices are at the address already given.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Local Government Provisional Order (Gas) Bill, Tottenham and Edmonton Gas Bill, York Corporation Bill.

Bills read a second time and committed: Derby Corporation Bill, Lymm Urban District Council Bill, Mid Kent and East Kent District Water Bill.

Bills reported: Broadstairs and St. Peter's Urban District Council Bill, Gas Orders Confirmation Bill, Huddersfield Corporation Bill, Tynemouth Gas Bill.

Bills read the third time and passed: Ebbw Vale Water Bill, Herne Bay Gas and Electricity Bill, Leeds Corporation Bill, United District Gas Bill.

The Pontypridd and Rhondda Joint Water Board Bill and the Westgate and Birchington Gas and Electricity Bill have been referred to a Select Committee, consisting of Lord Ribblesdale (Chairman), the Marquis of Linlithgow, Lord Monteagle, Lord Manners, and Lord Crawshaw; to meet next Tuesday.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Ebbw Vale Water Bill, Leeds Corporation Bill, Rochford Rural District Council Bill, United District Gas Bill.

Bills reported: Bournemouth Gas and Water Bill, Gas and Water Provisional Orders Bill (No. 2), Porthcawl and District Gas and Electricity Bill [Lords], Slough Gas Bill [Lords], West Bromwich Corporation Bill.

Bills read the third time and passed: Tottenham and Edmonton Gas Bill, York Corporation Bill.

WATER RESOURCES OF THE COUNTRY.

The House of Commons last Thursday, in Committee of Supply, had under consideration the vote of £185,988 to complete the sum required for the salaries and expenses of the Local Government Board. The vote gave rise to a debate, in the course of which reference was made to the action of the Board in the matter of rural water supplies and the apportionment of the water resources of the country.

Mr. LONG (a former President of the Board) moved to reduce the vote by £100. While criticizing the work of the Board, he said he did not wish to make any personal attack on the President (Mr. John Burns). The right hon. gentleman had done good work, but he had taken matters too much into his own hands—constituting himself the sole arbiter of what was good and what was bad for the local authorities. Greater advantage should be taken of the large experience and training possessed by the distinguished men with whom he was associated. If this were done, the administration of the department in the direction of improving the health and happiness of the people of the country would be far more satisfactory than it was at present.

Mr. LEIF JONES urged that the Board should deal thoroughly and systematically with the questions of drainage and water supply in rural districts, and that these important matters should not be left to haphazard action on the part of the local council or the whim of the local engineer. He considered the Board were open to criticism in this respect. Standard bye-laws were required for the drainage of villages, and systematic attention should also be given by the Board to the question of their water supply. The country should be mapped out, the sources of supply ascertained, and the water apportioned to the places which required it. At present there was a danger of powerful municipalities taking away from rural districts the water which the districts ought to have for themselves. There was great need for the systematic handling of the problem as a whole. He asked the President to give the Committee some information with regard to the return on the water supply ordered in 1910. The return had not yet been issued, and he would much like to know just what information it would contain.

Mr. HERBERT LEWIS (Parliamentary Secretary to the Board) said the Board had lost no opportunity of impressing on local authorities the necessity of providing a good supply of potable water and a proper system of drainage. As to taking a general survey of the water resources of the country, the question was one of great interest and public importance. The water needs of the country were constantly growing. The increase of population, the improving standard of cleanliness, and the extension of manufactures continually demanded a larger supply of water. The difficulty which was arising now to some extent, and which would be felt with greater stringency in twenty or thirty years, was that the available water resources of the country were fixed. The great watersheds still available for the supply of the large towns were continually diminishing in number; and it was therefore of considerable importance that the country should have some knowledge of the extent of the water actually available. A return was ordered by the House in 1910. Immediately afterwards the Board set about preparing the schedule and obtaining information from various authorities. They had received altogether more than 3000 separate returns. The general return would be issued shortly, and would show, as regarded every water undertaking, the place of supply, the source, the nature of the works, and the quantity and quality of the water. It would also give the area, population, and number of houses in every district and parish in England and Wales, and particulars relating to the water supply. He thought the return would be of considerable value, especially to Parliamentary Committees. The Local Government Board were extracting from the return all the information which bore upon underground water; they were dividing the water among the different geological formations in every county in England and Wales; and they were drawing up a statement of the amount of water drawn by public undertakers from each geological formation. As to the difficulties of local authorities in obtaining water supplies, the Board last year introduced a Bill for the purpose of enabling them to obtain these compulsorily. The Bill was then defeated; but he was not without hope it would be passed during the present session.

Sir MARK SYKES called attention to the question of the water supply in rural districts. The Under-Secretary of the Board (Mr. Herbert Lewis) had, he said, endeavoured to give those who were interested in rural districts some comfort by saying that certain great schemes were in progress, and that valuable information would be given. But he (the speaker) submitted that they wanted something practical done in the course of next year. He thought the right hon. gentleman at the head of the Board might bring more pressure to bear on local authorities in getting practical schemes carried through.

Mr. BURNS, in the course of his reply, said that, in order to give expression to the Board's view of one aspect of rural water supplies, a Bill was presented last year. It was on the paper again; and if it were passed, there would be no reason why the immediately critical part of the question should not be at once solved. He would be glad to do anything he could to help rural water supplies, and safeguard them from being unnecessarily raided by large companies and great towns. He believed it was possible to secure good water supplies for rural areas, and at the same time to supply large towns.

On a division, the amendment to reduce the vote was lost by a majority of 77.

BOURNEMOUTH GAS AND WATER BILL.

HOUSE OF COMMONS COMMITTEE.—Tuesday, June 10.

(*Before Mr.* HERBERT CRAIG, *Chairman, Mr.* HOGGE, *Mr.* GEORGE LLOYD, *and Mr.* POINTER.)

This Bill authorizes, among other things, the acquisition of the Christchurch Gas Company and the Wimborne Minster Water-Works Company by the Bournemouth Gas and Water Company—the promoters of the Bill.

Counsel for the Bill were Mr. J. D. FITZGERALD, K.C., Mr. HONORATUS LLOYD, K.C., and Mr. TYLDESLEY JONES; the only opponent—the Wimborne Urban District Council—being represented by Mr. WEDDERBURN, K.C.

Mr. FITZGERALD, in opening, said that the Bill was promoted by the Bournemouth Gas and Water Company to enable them to extend their limits of supply, to acquire, by agreement, the undertakings of the Christchurch Gas Company and the Wimborne Water-Works Company, to increase their capital, and for other purposes. The promoting Company was originally established as a limited Company in 1864, and was subsequently incorporated by Act of Parliament in 1873. Since then further Acts of Parliament had been obtained in the years 1878, 1896, 1902, and 1903. Under the Act of 1902 the Company took over the undertaking of the Poole Water and Gas Company, and now supplied water and gas throughout the whole of the borough of Bournemouth, except a small portion, supplied by the West Hants Water Company. In 1903, the Company was authorized to reconstruct the Poole Gas-Works, the result of which had been to confer great advantages upon the gas consumers in the whole of the Poole and Bournemouth area, inasmuch as manufacture was now carried on much more economically. This was seen by the fact that the Company supplied at the very low charge of 2s. 6d. per 1000 cubic feet. A district known as the Ferndown area, to the north of Bournemouth, had been supplied during the last few years by the Company, at the request of the local authority of the district, and also consumers; and it was now proposed to make this area a part of the Company's statutory area of supply. It was not possible, however, to supply in this area at the same rates as in Bournemouth. The rates hitherto had been somewhat higher, and there had been no objection on this ground. Under the Bill it was proposed to continue the existing rates. Coming to the purchase of the Christchurch Gas Company's business, Counsel pointed out that this was being done by an agreement which was scheduled to the Bill. The Christchurch Company was incorporated in 1877, and in 1903 the management passed into the hands of the present Directors. Prior to 1903, the Company had been largely in the hands of one individual. Since the change on the Board, the administration of the Company had been closely allied to the administration of the Bournemouth Gas and Water Company. There was the same General Manager, and in other respects the administration was very much the same; and it was now felt that if the two undertakings were merged it would be for the advantage of the consumers of gas in Christchurch to be supplied by the Bournemouth Company, who were manufacturing on a much larger scale. Christchurch itself was not a large place, and a good portion of the area was sparsely populated. The price of gas in Bournemouth was 2s. 6d.; in Christchurch, 4s. 2d. If the existing Christchurch Company were to continue, the reductions would come very gradually indeed, whereas under the transfer there would be much better prospects for the consumers. The agreement for purchase left the price to be paid for the Christchurch undertaking to be settled by an arbitrator, and Mr. Ram, K.C., had been nominated to act in this capacity if the Bill received the Royal Assent. Meantime, it had been proposed that the price of gas in Christchurch should be reduced to 3s. 6d., with a further reduction of 2d. every two years, until it reached a price not exceeding 4d. higher than that charged in Bournemouth. The supply to Christchurch must necessarily be more expensive than the supply to Bournemouth; and this differential rate of 4d., which would be arrived at at the end of eight years, would mean that the Christchurch gas

consumers would get their gas at a much lower price than they could hope to obtain it under the present conditions. On the other hand, the Bournemouth Company, by reducing the price in Christchurch, expected to find the consumption of gas there increased considerably. To this purchase proposal, there was no opposition. The other proposal in the Bill was with regard to the area of the Wimborne Water-Works Company. Wimborne was a small country town, with a population of between 3000 and 4000 people, and it was supplied with water by a small limited Company, who obtained a Provisional Order in 1888, and a further Provisional Order last year. The supply of water was mainly obtained from a borehole, and partly from a spring. He believed the borehole did not yield sufficient water to give the Company much to fall back upon. In 1896, when the Bournemouth Company obtained an Act authorizing them to sink a deep well at Wimborne within 550 yards of the Wimborne borehole, it was arranged that the Bournemouth Company should, if the necessity arose, give the Wimborne Company a supply up to 70,000 gallons per day at the nominal price of £10 per million gallons. The reason for this was that it was feared that the operations of the Bournemouth Company might considerably reduce the quantity of water obtained from the Wimborne Company's borehole; and as the Bournemouth Company realized the difficulty, they assented to the terms already mentioned. The amount of water which the Bournemouth Company could take from their Wimborne well was unlimited; but only a certain quantity per day had hitherto been taken. Consequent, however, upon the growing needs of their district, it was the intention of the Company to pump a considerably larger quantity in the near future, and the Directors considered that this would be a hardship upon the Wimborne Company, and might even possibly divert their water supply altogether from their borehole. Consequently it was felt that some steps should be taken in the interests of the Wimborne consumers; and negotiations took place between the two Companies with the view of obviating any difficulty of this sort, and seeing if the two Companies could not be merged. Accordingly, an agreement was come to, which was also scheduled to the present Bill. The capital of the Wimborne Company consisted of 10 per cent. stock; but only 7 per cent. had been paid upon it for several years, although there was, of course, the possibility that the 7 per cent. might be increased. This was a matter which had to be taken into account in arranging the price to be paid, as was also the fact that the Company could, when their financial position permitted, pay back-dividends. The negotiations had resulted in an arrangement that for every £10 share held in the Wimborne Company, and now receiving 7 per cent., the Bournemouth Company would give a £10 share entitled to 7 per cent.; but having regard to the prospective value, and also, as already mentioned, to the possible payment of back-dividends, it had been agreed to give the sum of £5 in cash, in addition on each £10 share. On both sides, this was regarded as a reasonable thing. Another advantage to the Wimborne consumer under the agreement was that, when the Wimborne Company was absorbed, the Bournemouth Company's softened water would be supplied in Wimborne. The Wimborne consumers also got guarantee of the larger Company, with the larger works, that their supply would not be interrupted. With regard to water-rates, it was proposed to continue the existing rates in Wimborne. These had been fixed in the Wimborne Order of 1888; and when the Wimborne Company was before Parliament last year and obtained another Order, no objection of any sort was raised to the rates, which, in fact, having regard to the district, were quite moderate. It was this point to which the opposition of the Wimborne Urban District Council was mainly directed. The water-rates, both in Bournemouth and Wimborne, were based upon the rateable value; and the contention of the Wimborne Urban District Council, that the percentage on the rateable value charged in Bournemouth and in Wimborne should be the same—at present it was larger in Wimborne—was rather a fallacious one. The rateable value of similar property in the two places was a good deal higher in Bournemouth than in Wimborne, and thus, to obtain the same return from two similar classes of property in the two places, the percentage on the rateable value must necessarily be somewhat higher in Wimborne than in Bournemouth. The suggestion which would be put before the Committee on behalf of the Urban District Council was that the water-rates in Wimborne should be reduced to the Bournemouth scale. But the effect of this would be that the Wimborne undertaking would be carried on at a loss, which would have to be borne by the consumers of water in Bournemouth—a most unfair thing. In fact, if the Company had made such a proposal, it would no doubt have excited opposition from the other portion of their area. Furthermore, the Bournemouth Corporation had been agreed with that the existing rates in Wimborne should continue for, at any rate, ten years. Finally Counsel referred to reports by the Home Office and the Local Government Board, which, he said, could be dealt with in detail later, as they were clause questions; but there was one matter of importance which should be referred to then. The Local Government Board pointed out that there were a number of provisions in the existing Bournemouth Company's Act which were similar to corresponding provisions in the Water-Works Clauses Act and the Gas-Works Clauses Act; and the question was raised as to whether it was desirable to have these provisions repealed from the Company's Acts and included by incorporating the Water-Works Clauses Act and the Gas-Works Clauses Act. His answer to this was that the manner in which these matters had been dealt with by the Company in the past had not created any difficulty or dissatisfaction, and when dealing with an ordinary water consumer it was much more convenient for him to turn up the Special Act of the Company and see what the provisions were, rather than have to search through a number of incorporated Acts.

Mr. *William Cash*, a Director of the Bournemouth Gas and Water Company, supported Mr. Fitzgerald's opening statement. He mentioned that the Bournemouth Corporation had originally petitioned against the Bill; but certain slight alterations had been made to meet their objections—including a reduction in the amount of additional capital proposed from £200,000 to £150,000—and the Bournemouth Corporation did not now appear. Dealing with the question of water charges as between Bournemouth and Wimborne, he pointed out that the Bournemouth charges were exceptionally low, having regard to the rateable value of the property which was supplied, and, furthermore, there were no charges for extras—such as water-closets and baths. On the other hand, there was not a great deal of difference between the amount paid for water on the higher rated property in both districts—the biggest differences occurring with the cheaper class property. For instance, whereas a £12 rateable value house in Bournemouth would only pay 8s. 8d. per annum, a similarly rated house in Wimborne would pay 17s. a year, *plus*, as already mentioned, the extra charge for water-closet or bath, as the case may be. On the present basis, he anticipated that there would be a slight loss on the working of the Wimborne undertaking after meeting interest on the capital necessary for the purchase.

In cross-examination by Mr. WEDDERBURN, witness said that the extra loss which would be incurred by equalizing the rates in the two districts would be £400 per annum; but Counsel replied that, assuming an increase of 25 per cent. on the revenue, which might fairly be done, there would be a profit of £300 a year. In any case, said Counsel, it was going to be a great advantage to the Bournemouth Company to acquire the Wimborne undertaking, if only for the fact that they relieved themselves of the possibility of having to supply 70,000 gallons a day at the nominal rate of £10 per million gallons. It was also put to witness that by the amalgamation scheme the Wimborne Urban District Council would be precluded for ever from exercising its rights of purchase, and getting the supply of water in its own district into its own hands, and that if the Bournemouth Company were coming to Parliament for the first time for the Bournemouth and Wimborne areas together, it was not the practice of Parliament to grant differential rates for different parts of the district. Witness, however, expressed a doubt as to whether, in such a small place, the Urban District Council would wish to purchase, and in any case, if they did, they would have to accept the Wimborne Company's position with regard to the possibility of their well being depleted by the larger pumping from the Bournemouth Company's well close by.

Mr. POINTER called attention to the fact that it was the working-class houses in Wimborne which had to pay the highest rates, in comparison with similar class property in Bournemouth; and to this witness assented.

The CHAIRMAN asked the promoters if they were willing to accept a clause that, in the event of a reduction in the price to Bournemouth consumers, a corresponding reduction should be made to Wimborne.

Mr. FITZGERALD said the promoters would be willing to accept this.

Mr. *Harold Woodall*, the General Manager of the Bournemouth Gas and Water Company, also gave evidence, in the course of which it became evident that the Committee were very much exercised in their minds as to the position of the smaller class property in Wimborne.

The CHAIRMAN said the Committee would like the evidence directed very largely to the difference of charges on the working-class property in the two districts.

Witness said that the question of the 8s. 8d. charge in Bournemouth against the 17s. charge in Wimborne was not so serious as it might appear, as most of the working class and labourers' houses in Wimborne were not supplied by the Company at all, but obtained their water from their wells.

In cross-examination by Mr. WEDDERBURN, as to the advantage which the Bournemouth Company hoped to get out of the transfer, witness agreed that it was the intention to pump twice the present quantity of water from their well at Wimborne, and that there was the possibility of so depleting the Wimborne Company's well that the Bournemouth Company would have to carry out the terms of the agreement and supply the Wimborne Company with 70,000 gallons a day, to enable them to meet the demands of their consumers. In these circumstances, the Bournemouth Company were clearly promoting the transfer in order to relieve themselves of the disadvantage which the carrying out of this agreement would undoubtedly put them under, and that consequently the Wimborne consumer should be treated on equal terms with the Bournemouth consumer.

This concluded the case for the Bill.

Mr. REGINALD PARKER (of Messrs. Sharpe, Pritchard, and Co., Parliamentary Agents), on behalf of the Bournemouth Corporation, said that body was satisfied that the extensions were justified; but they would have appeared on their petition against the Bill had they not agreed with the promoters that the Bournemouth consumer should not be penalized at the expense of the Wimborne consumer by any reduction in the Wimborne rates. He therefore asked the Committee to accept the Company's proposal on this point.

Mr. WEDDERBURN did not call any evidence, but addressed the Committee, and made the points already referred to in the cross-examination of the Company's witnesses. He said there was a strong feeling of injustice on the part of the Wimborne consumers that they should be supplied by a Company who were already supplying another portion of their consumers at a lower rate.

The CHAIRMAN pointed out to Mr. Wedderburn that the consumers in the Ferndown district would be charged at a higher rate than the Bournemouth consumers, and that therefore, whatever was done as regards Wimborne, the principle of "one rate, one area," advocated by Mr. Wedderburn, could not apply.

Mr. WEDDERBURN replied that probably it was a short-sighted policy on the part of the Ferndown consumers not to have appeared in opposition to the Bill on this point.

The CHAIRMAN, after consultation with the Committee, announced that the decision, by a majority, was in favour of the proposal of Mr. Wedderburn—that there should be one rate.

The promoters accepted this decision; and the necessary adjustments were subsequently made in the Bill.

Mr. TYLDESLEY JONES, on behalf of the promoters, then dealt with the reports of the Local Government Board and the Home Office. The main point of the Home Office report, as already pointed out by Mr. Fitzgerald, was that there were a number of clauses which overlapped with what were regarded as Model Clauses in the Gas-Works Clauses Act and the Water-Works Clauses Act, and in addition to the argument as to convenience already used by Mr. Fitzgerald, it was pointed out that Parliament had sanctioned these clauses in the Company's Acts at dates subsequent to the passing of the Clauses Acts referred to, and although the Company had been working under their Acts, framed as they were, for so many years, there had never been

any complaints from the local authorities. If the Committee desired it, he could go through every clause mentioned in the Home Office report, and give evidence as to why the Company should retain their present code.

The CHAIRMAN said that the substance of the Home Office report was to direct the attention of the Committee to the fact that the Company had certain clauses in their Acts which would not be granted by Parliament nowadays as separate clauses, unless there were special reasons; and the report pointed out that this was the opportunity for getting rid of them.

Mr. TYLDESLEY JONES replied that this was so, and that there was really no objection on the part of the Home Office to the present position of affairs. There was only one instance in which the clauses in the Company's Acts differed from the Model Clauses, and that was the penalty for using water for other than domestic purposes. In the Bournemouth Acts this was £5, whereas in the Model Clause it was 40s. But this was granted to the Company as long ago as 1873; and there had never been any complaints about it.

The CHAIRMAN said that the Committee were of the opinion that they would not trouble the promoters to go into this matter, as the Committee did not feel it was in the position to force upon the Company the suggestions of the Home Office unless the latter took stronger steps with this end in view than they had done in their report.

The few minor objections raised in the Local Government Board report having been met by the promoters, the Bill was ordered to be reported for third reading.

HEATHFIELD AND DISTRICT WATER BILL.

HOUSE OF COMMONS COMMITTEE.—Wednesday, June 11.

(*Before Mr.* HERBERT CRAIG, *Chairman, Mr.* HOGGE, *Mr.* GEORGE LLOYD, *and Mr.* POINTER.)

The Bill provides for the incorporation of the Heathfield and District Water Company, and for the acquisition of the water undertaking of the Ticehurst and District Water and Gas Company.

Counsel for the Bill were Mr. C. C. HUTCHINSON, K.C., and the Hon. G. TREVOR LEWIS. The only opponent was the Ticehurst Rural District Council, who were represented by Mr. G. M. FREEMAN, K.C., and Mr. TYLDESLEY JONES.

Mr. HUTCHINSON, in opening, explained that the proposal of the Bill was to incorporate, in a statutory Company, to be known as the Heathfield and District Water Company, certain undertakings, such as they were, now supplying water in the districts of Heathfield, Ticehurst, and Waldron, and to add to this area the small district of Hellingly. Under an agreement scheduled to the Bill, the undertaking of the Heathfield Company would be taken over as well as the water portion of the Ticehurst and District Water and Gas Company. When the purchase was completed, a supply would be given in the added area of Hellingly, where the supply to the district of Waldron, now being given by the existing Heathfield Company, would be legalized. In addition, powers were sought to construct a new well in the district of Ticehurst, which it was anticipated would provide five times the amount of water now obtained from the existing well in the same parish. The capital of the new Company would be £30,000, with £10,000 borrowing powers. The new Company was being formed by local gentlemen. So intimately were the promoters interested in the district, and so desirous were they of seeing the water supply put upon a satisfactory basis, that they had themselves subscribed the money needed for the purchase of the existing Heathfield Company. Even if no further capital was raised, there were still sufficient funds to carry on the undertaking. Both in Ticehurst and Heathfield the supply of water was in a very unsatisfactory state, mainly owing to what Counsel termed the swindling methods adopted on their formation, with the result that they eventually found themselves in the hands of receivers. The local people, anxious to see things put right, purchased the Heathfield undertaking from the Receiver, and also the Ticehurst Company's water undertaking—in the former case, for the exact value of the capital expenditure, and in the latter for £9000, although an independent expert had valued the undertaking at between £13,000 and £15,000. The cost of a new well was put at £800, and extensions of mains at £500. Sufficient money had already been subscribed to provide £2250 working capital after completing the purchase. On the present income basis, a dividend of 4¼ per cent. would be earned on the capital—the total sales amounting to 17,800,000 gallons per annum; while in ten years' time, with an estimated sale of 24,250,000 gallons per annum, it was calculated that the return would be 4¾ per cent. But the promoters were not so concerned about large profits as getting the supply into their own hands and safeguarding the district from a repetition of what had gone on in the past. The only petition against the Bill was by the Ticehurst Urban District Council, whose sole desire was, apparently, to see that the safety of the supply of water to the district was secured. On this point he could inform the Committee that whereas the present demands amounted to 80 million gallons, the well of the Company could supply 114 millions; and when the new well was sunk, this would be increased to 300 millions. Therefore, on the question of quantity, the district was amply safeguarded. The allegation was made that the sinking of the new well near to the old one would deplete the supply from the latter; but expert evidence would show that this was not so. He was, however, prepared to insert any reasonable provisions which the Committee might think necessary to safeguard the water supply in the district.

Mr. *W. Matthews*, the Consulting Engineer to the Company, gave evidence in support of the proposals in the Bill.

In reply to Mr. FREEMAN, in cross-examination, witnessed denied that there were any signs of exhaustion at the existing well. There was plenty of water there, although the inflow from the natural underground reservoir was not so rapid as the rate at which the pump could lift the water from the well. Witness denied that the existing well was badly situated, and that the new one should be placed elsewhere. Counsel then objected to the clause giving the Company power to supply water in bulk to outside authorities, on the ground that such supplies might prejudice the supply for domestic purposes inside the area. The reply was that there would be ample water for all purposes when the new well was constructed. Counsel pressed the point as to there being sufficient even for the needs of the Company's own area when the new well was sunk; and witness eventually agreed to the insertion of a clause in the Bill, if the Committee thought fit, compelling the Company to sink other wells or procure other sources of supply if it were subsequently found that the new well did not give sufficient, in order to obviate having to come to Parliament again.

Mr. *Herbert Lambert* was called to show that the underground sources of supply in the district were ample, and that there would be no advantage in sinking the new well in another spot to that proposed.

Mr. *E. M. Eaton* supported the previous evidence. With regard to a suggestion by Mr. Freeman, that the Company should be under a penalty of £20 if they did not seek other sources of supply after notice from the Board of Trade that their existing supply was insufficient, he said he did not know of any precedent for such a suggestion.

This closed the case for the Bill.

Mr. *C. E. Hawkins*, a geologist, was the first witness for the opposition. He advocated sinking the new well some distance away from the existing one, as there the supply did not flow into the well quickly enough to meet the demand. Consequently, to sink a new well close by would not increase the supply.

Other evidence was called which was intended to show that there had been difficulty in obtaining water in the neighbouring areas.

The CHAIRMAN, however, said the Committee were satisfied that the new well would increase the supply.

Mr. TYLDESLEY JONES, in addressing the Committee, said that the Ticehurst Council had no hostility to the new Company, but merely wished to safeguard the water supply of the district. He asked for a clause providing that if it were found that there was not sufficient water then some public authority should compel the Company to find other sources. All the Council wished to do was to safeguard the consumers against a shortage of water, having regard to the history of the Company's predecessors.

Mr. HUTCHINSON replied on behalf of the promoters.

The CHAIRMAN said the Committee passed the preamble of the Bill subject to the deletion of the clause relating to bulk supply in outside areas.

Friday, June 13.

On consideration of clauses this morning, Mr. Freeman's proposed clause as to other sources of supply and a penalty was refused.

Mr. FREEMAN, among other suggestions, asked for a clause compelling the Company to give a supply to the Council for public purposes at 1s. 6d. per 1000 gallons at any point required within 100 yards of the Company's mains, without any guarantee as to the quantity which might be taken.

The Hon. TREVOR LEWIS objected, on the ground that this might lead to a very great hardship on the Company, inasmuch as the Council could require a supply at any number of points 100 yards away from the mains, to which the Company would have to lay the necessary connections, and there was no guarantee such as the Company could demand from a private consumer.

The Committee decided that the Company should give such a supply; but only at points where their mains were laid. In other words, the Company should not be compelled to lay mains for the purpose.

The Bill was then ordered to be reported for third reading.

WEST BROMWICH CORPORATION BILL.

Section B of the Local Legislation Committee of the House of Commons, under the chairmanship of Mr. GARDNER, had this omnibus Bill under consideration again last week. Section VIII. of the Bill relates to the Corporation gas and electricity undertakings, to the clauses in which there was no opposition. There was, however, the usual discussion in Committee on these clauses, many of which are in the Model Bill form.

Clauses 101 to 105 deal with the quality, pressure, testing-place, and testing of the gas, with the construction and placing of pipes between main and meters, and authorizes the Corporation to contract for the supply of gas in bulk to neighbouring districts. Clause 108 gives powers to lay pipes for ancillary purposes, to remove tar, or other materials "used by them in, or relating to, their own manufacture of gas or any residual products thereof."

Mr. RHODES, of the Local Government Board, suggested that the latter words should be limited to manufacture "by them."

Mr. COOPER (the Parliamentary Agent for the Bill): You are raising the question which we fought out before the Joint Committee of the House of Commons and House of Lords, who reported practically that these words should not be in.

Mr. RHODES: My objection is that under this clause you may work up other people's residuals.

Mr. COOPER: Certainly.

Mr. RHODES: Do you say that the Joint Committee did not object to this?

Mr. COOPER: The Committee said that we should not have any restrictions put upon us.

Mr. RHODES: Then I entirely withdraw my objection.

The clause was added to the Bill.

Clauses 110 and 111 refer to stand-by supplies, both in the case of the supply of gas where the consumer has an electrical installation, or where he has a separate gas installation. Some objection was taken to this.

Mr. COOPER explained that though the clauses are not actually in

the Model Bill, they were put in nearly every Gas Bill, and are allowed by Committees as a matter of course.

The clauses were added to the Bill.

Clause 113, providing that gas-fittings should be free from distress, was added to the Bill.

With regard to clause 115, which provides that the Corporation may supply and fix burners suitable for the illuminating power prescribed by the Act in the place of any burners at present used, this was merely an enabling power; but the Local Government Board raised the question as to whether it should not be obligatory. It was pointed out that this question had been considered in connection with Gas Companies Standard Burner Removal Bills; and the Committee who considered them left in merely the enabling power now asked for. No. 1 Bill, said Mr. Jeeves, the Counsel for the West Bromwich Corporation, was very heavily fought indeed, especially by the Corporation of Liverpool. One thing which it was sought to impose upon the Liverpool Gas Company was that they should supply gas-burners free of cost; but Committees of both Houses decided that a company should be free to use what was known as the standard burner without any obligation. These Bills were followed by another Bill promoted by the Joint Gas Companies in the following session, and again no restrictions were put upon them. The Committee in that case practically held the view that the standard burner was the thing Parliament intended them to have; but they were not to be under any special conditions with reference to its use.

The CHAIRMAN stated that the opinion of the Committee was that the word "may" should come out and the word "shall" be put in.

Mr. JEEVES pointed out a difficulty if this were done, because it meant that the Corporation could be called upon at any time to replace existing burners, whereas it was only fair that any change of burner should apply merely to the change of candle power under the Bill. There should be a time limit within which a consumer could ask for the change to be made.

After some discussion, the following clause was decided upon, to meet this point.

(1) The Corporation shall at any time within two years after the 1st day of January, 1914, if and when required by any consumer of gas supplied by the Corporation (other than a consumer by prepayment meter), supply to him and fit free of charge a sufficient number of flat-flame burners suitable in all respects for the consumption of gas of the illuminating power prescribed by this Act in substitution for the flat-flame burners in use before the said 1st day of January.

(2) The Corporation shall also, as soon as reasonably practicable after the said 1st day of January, 1914, and at the latest within a period of three months thereafter, exchange the flat-flame burners used by consumers of gas supplied by the Corporation by means of prepayment meters for flat-flame burners, similarly suitable for the consumption of gas of the illuminating power prescribed by this Act.

(3) Notice of the provisions of this section shall be given on each demand note of the Corporation set out during the first-mentioned period of two years.

The few remaining clauses in the gas section were added, and the Bill was subsequently ordered to be reported for third reading.

SLOUGH GAS BILL.

This Bill, which extends the limits of the Company's area of supply, authorizes the conversion of the Company's preference shares into one class of 5 per cent. preference stock, and the raising of additional capital to the extent of £50,000, was last Thursday ordered to be reported for third reading by the Unopposed Bills Committee of the House of Commons.

Mr. CASH explained to the Committee that the Company was incorporated in 1866, and had since obtained various powers under other Orders. In 1901, further capital to the extent of £25,000 was obtained, as the whole of the capital under the Order of 1866 had been exhausted. One immediate reason for the additional capital was that the Company had recently erected a new holder at a cost of £5000. The remainder of the new capital asked for was expected to last the Company for the next twelve years, having regard to the increase in consumption during the past twelve years. The output at present was 70 million cubic feet per annum, which was double what it was twelve years ago; and the increase was going on at the same rate.

The attention of the Committee was drawn to the fact that clause 28, giving the power to create a special purposes fund, was not quite in the model form; but the Committee allowed it to remain. Under the Bill, the candle power is reduced to 14, and the price of gas in Slough is being reduced by 2d. The standard price in Slough is 4s. 5d. per 1000 cubic feet, and in the additional areas taken in by the Bill, where the Company are going by request, the standard price is to be 4s. 8d., with the proviso that the price charged in the outside districts shall not at any time exceed by more than 3d. that charged in the other part of the area.

BRUMBY AND FRODINGHAM URBAN COUNCIL BILL.

Applications for "Locus Standi."

COURT OF REFEREES.—Wednesday, June 11.

(*Before Mr.* M'LEAN, *Chairman, Mr.* E. MOON, *Speaker's Counsel, Sir* WILLIAM BYLES, *Mr.* HILLS, *and Mr.* STAVELEY-HILL.)

Applications were made by the Great Central Railway Company and the Frodingham Iron and Steel Company for *locus standi* to appear against this Bill when it reaches the Committee stage. The Bill authorizes the Urban District Council of Brumby and Frodingham to purchase the gas-works and plant of the Urban District Council of Scunthorpe, so far as these relate to the Brumby and Frodingham area, and also authorizes the latter to supply in a certain area outside the Council's boundary.

Mr. VESEY KNOX, K.C., appeared for the Council; Mr. LYNDEN MACASSEY, K.C., for the Great Central Railway; and Mr. C. C. HUTCHINSON, K.C., for the Frodingham Iron and Steel Company.

Mr. VESEY KNOX objected altogether to *locus* being granted to the Frodingham Iron and Steel Company, but conceded that the Great Central Railway Company was entitled to *locus* as consumers, because a consumer, it had been held, was entitled to be heard against a change in the supply authority; but he objected to *locus* being granted to the Company against any other portion of the Bill than Part II., which deals with the transfer of the gas-works only.

Mr. LYNDEN MACASSEY, for the Great Central Railway Company, argued that as an owner of property which was liable to be injuriously affected by an increase in the charge for gas, or, alternatively, an increase in the local rates by reason of the local authority carrying on the gas undertaking at a loss, he was entitled to appear against the Bill in its entirety. Incidentally, he pointed out to the Committee that the Local Government Board had reported adversely upon the proposals in the Bill, which they described as being an "inexpedient undertaking."

Mr. HUTCHINSON, on behalf of the Frodingham Iron and Steel Company, claimed *locus* first as a consumer; secondly, on the ground that his Company were now supplying part of the district with electricity; and, thirdly, as an owner of property which might be injuriously affected by the imposition of increased rates in consequence of the carrying on of the gas undertaking at a loss.

Mr. VESEY KNOX, replying, said he doubted whether the parties were entitled to be heard as owners. Certainly the Railway Company in their petition had not alleged that their property would be injuriously affected or depreciated, and for obvious reasons—because any effect upon their property must necessarily be so exceedingly small that they could hardly venture to put up such a statement. He had conceded *locus* as to Part II.; and this would enable the Railway Company to raise almost every point they desired. In view of the Local Government Board report, however—which had not yet been fully considered by the Council—there was a possibility of Part II. coming out of the Bill. In this event, he saw no reason why the Railway Company should have the right to oppose the remainder of the Bill, which gave the Council the right to erect works of their own, apart from the transfer of the portion of the works of the Scunthorpe Council under Part II.

Mr. MOON said he did not think this would be the case. With *locus* against Part II., the Company could only oppose the purchase of the works of the Scunthorpe Council.

Mr. VESEY KNOX said that, apart from Part II., the Railway Company could only appear as ratepayers; and he knew of no case in which this had been allowed. They could appear as consumers and as owners, but then they must show some special circumstances. As to the Frodingham Iron and Steel Company, if they were to be allowed *locus*, then there was no reason why any owners could not petition against any Bill of a local authority. Such a decision could only be mischievous. There had been cases of property owners being granted *locus standi* at Bristol and Glasgow; but there were other grounds than mere injury to property. Furthermore, he pointed out to the Court that the objects of the Bill were the ordinary objects of a local authority.

Mr. MACASSEY maintained that this was not quite so, as it was proposed to supply gas to a district outside the local boundaries.

The CHAIRMAN subsequently announced that the Court would allow general *locus* to the Railway Company as consumers of gas, because the interests of the Company were so closely connected with the whole of the Bill. With regard to the Iron and Steel Company, the Court allowed general *locus* on the allegation of injurious affection of their property by the proposals of the Bill.

PROGRESS OF SUNDRY PRIVATE BILLS.

The following Bills were before various Committees of Parliament during the past week, and were sent forward for third reading.

Aberystwyth Corporation Bill.—This Bill confers further powers on the Corporation *inter alia* with regard to the water undertaking. A new line of conduit is to be laid from the Corporation's Llyn Llygad Rheidol reservoir; and, in addition to providing for an extension of the limits of supply, a number of Model Bill clauses are included, dealing generally with the water undertaking.

Gas and Water Provisional Orders (*No.* 2) *Confirmation Bill.*—This Bill, which confirms four Gas and Water Provisional Orders, was before the Unopposed Bills Committee of the House of Commons on Thursday. The following are the Orders: (1) Faversham Order. This extends the limits of supply of the Faversham Gas Company, authorizes the purchase of the Boughton Blean Gas and Coke Company, and also gives powers to use lands for gas purposes. Clause 9, which deals with the latter, did not, in the Order as drafted, deal with residual products; but the Local Government Board have now added the words "to enable the undertakers to construct works for the purpose of dealing with residual products," which rectifies this omission and brings the Company within the report of the Joint Committee on residuals. (2) Hawkhurst Order. Under this, the Hawkhurst Gas Company are incorporated as a statutory Company, with powers to raise £6000 additional capital. (3) Penistone, Thurlstone, and Oxspring Gas Order. This empowers the Company to extend their limits of supply, to raise £6500 additional capital; and to purchase additional lands. (4) Wey Valley Water Order. In this, the Company are authorized to construct additional works and to raise £40,000 further capital.

Gas Orders Confirmation Bill.—In this Bill, which was before the Unopposed Bills Committee of the House of Lords on Tuesday, were included the following: (1) Kibworth Gas Order. This incorporates the Kibworth Gas Company, with a share capital of £16,000, consisting of ordinary share capital already raised by the existing Limited Company amounting to £9000 with additional capital of

£7000. The Company are authorized to continue the existing gas-works, and to sell, provide, and deal in coal, tar, and all other residual products. Fourteen-candle gas is prescribed, and the "Metropolitan" argand No. 2 burner is to be used for testing. The standard price is 3s. 8d., with the usual sliding-scale. The Company are given power to supply gas-fittings, to lay pipes in streets not dedicated to public use, and a stand-by clause is included. (2) Midsomer Norton Gas Order. By this Order the Midsomer Norton Gas and Coke Company are authorized to raise additional capital not exceeding £9000, including premiums. The standard price is in future to be 5s.; and the Order authorizes the construction of further gas-works, in addition to bringing the Company under the usual terms of modern gas legislation. (3) Redditch Gas Order. The Company are authorized to raise additional capital to the extent of £50,000, and to construct additional gas-works. (4) West Staffordshire Gas Order. Additional capital to the extent of £9000 is authorized to the present owner of the West Staffordshire Gas-Works, who trades under the name of the Brewood Gas Company, with powers to purchase additional lands to erect gas-works. The price of gas under the Order is not to exceed 5s. 10d. per 1000 cubic feet. The Order also contains many provisions from the Model Bill.

Huddersfield Corporation Bill.—The Committee of the House of Lords presided over by Lord Clinton had this Bill under consideration on Tuesday. The Bill deals with a number of matters; but the water portion was unopposed. The main object of the latter is to purchase the water undertaking of the Deanhead Commissioners.

Metropolitan Water Board Bill.—Lord Clinton's Committee concluded the consideration of this Bill on Tuesday. As already mentioned in the "JOURNAL" (p. 752), the chief outstanding point was with regard to the proposed railways at Hampton, which were, in a sense, opposed by the police authorities on the ground of possible obstruction to the ordinary traffic. Certain additions, however, were made to the clause in regard to dealing with this objection, which met with the approval of the Home Office, and the construction of the railways in question was sanctioned. Clauses were then gone through.

Morley Corporation Bill.—A Committee of the House of Lords, presided over by the Duke of Bedford, dealt with this Bill on Tuesday last. It is an "omnibus" measure, and Parts II. and III. refer to the Corporation water and gas undertakings respectively. There was, however, no opposition to these portions of the Bill. Part III., relating to the Corporation gas undertaking, deals wholly with substituting a calorific value test for the present illuminating power test, in addition to a clause dealing with anti-fluctuations on gas-engines. The terms of the calorific value clauses were dealt with in the "JOURNAL" for Jan. 28 last, p. 235. With regard to the water portion, this consists of a number of clauses for the better management of the undertaking, and most of them Model Clauses. Under clause 8, however, the water-rate in respect of property rated at £10 or under is to be paid by the owner. Clause 9 provides for cisterns to be installed in all premises supplied by the Corporation capable of holding a 48 hours' supply.

Porthcawl and District Gas.—This Bill was before the Unopposed Bills Committee of the House of Commons on Thursday. Originally the Bill, which has already passed the House of Lords, included powers to supply electricity; but these have since been abandoned, and did not appear in the Bill as it came before the House of Commons. The capital of the Company is to be £63,000, of which £45,060 is additional, and the Company propose, instead of paying a standard dividend of 10 per cent. on the original capital and 5 or 7 per cent. on the additional capital, to make it all one class of stock at the rate of 6 per cent. The standard price is 3s. 10d., although the Company originally proposed 4s.; the change having been made in consequence of a report by the Local Government Board. The Company paid no dividend for several years; but the average rate since the commencement of the Company in 1868 has been 4½ per cent. For the past three years, it has been 10 per cent.

ELECTRIC LIGHTING PROVISIONAL CONFIRMATION (No. 2) BILL.

Opposition to the Northwood Order.

A Committee of the House of Lords, presided over by the DUKE OF BEDFORD, considered last Thursday and Friday the Electric Lighting Provisional Order (Extensions) granted to the Northwood and Ruislip Electric Lighting Company, which was opposed by the Rickmansworth Urban District Council.

Mr. G. M. FREEMAN, K.C., and Mr. TYLDESLEY JONES appeared for the Company; and Mr. POLLOCK, K.C., and Mr. A. M. PADDON represented the Rickmansworth Urban District Council.

Mr. FREEMAN, in opening, explained to the Committee that the Bill includes a Provisional Order extending the area of the existing Northwood and Ruislip Electric Lighting Company, who have no generating station of their own, but take a supply of electricity in bulk from the Metropolitan Railway Company—there being also two alternative sources of supply from the Watford Urban District Council and the North Metropolitan Electric Power Supply Company in the event of any failure of the supply from the Metropolitan Railway Company. The reason for the present order was that from time to time the Company continued to receive applications from individual houses just over the existing boundary, in respect of which several applications had to be made to the Board of Trade for permission to supply these houses. As the number of these applications was increasing, the Company thought it the wisest course to apply for a Provisional Order adding a certain portion of the outside area to the existing limits of supply—in fact, the present promotion was mainly at the suggestion of the Board of Trade, in order to obviate constant applications in respect of single houses. The Local Authority for the district proposed to be taken in was the Watford Rural District Council, who had opposed at the local inquiry; but their objections were over-ruled. The present supply in the district was 6d. per unit for electric current compared with 3s. 6d. for gas in the same area. The profits of the Northwood Company had been steadily rising. In 1907, they were £297; in 1912, they had risen to £1357; and for the past three years the Company had paid 5 per cent. The only opponent to the Bill was the Rickmansworth Urban District Council, whose interest he thought was very remote. They were not the local authority for any part of the district which it was proposed to add to the Company's area; but the Rickmansworth Council were the gas authority for the proposed added area, and the only ground for their appearance before the Committee was that the electric light undertaking would be in competition with them for the supply of gas in this area. In his opinion, however, it was a district which was entirely unsuitable for gas; and he did not see what harm could be done. As a matter of experience, the Board of Trade did not recognize competition between gas and electricity, because they held the view that electricity and gas were generally used for different purposes, and frequently both were installed in the same house. Furthermore, the competition feared by the Council was not a very strong one, as they were supplying practically no gas in the district, although they admitted they had spent considerable sums of money in laying gas-mains, with a very inadequate return. The Electric Light Company were at present supplying thirteen houses in the district proposed to be added; and it would appear that, on the whole, the inhabitants preferred electricity to gas. The Electric Light Company had spent £22,000 upon their undertaking.

Mr. *H. W. Couzens*, the Consulting Engineer and Managing Director of the Northwood Company, gave evidence in support of the Bill. In cross-examination by Mr. POLLOCK, who criticized the inadequate provision for depreciation in the Company's accounts, he stated that it was unusual in the early years of any undertaking to provide for depreciation; and the amount set aside in this instance was well up to the average of many much larger undertakings.

Mr. *R. H. F. Hitchins*, the Secretary to the Company, was also called and cross-examined on the same matter, Mr. POLLOCK pointing out that only £650 had been set aside during the whole existence of the Company.

Mr. *J. Devonshire*, the Managing Director of the Metropolitan Electric Power Supply Company, and Director of the Northwood Company, stated that the amount set aside for depreciation was, in his opinion, adequate, and that if the Company had set aside sums for depreciation before they were actually earning profits, the entries would merely have been book ones, and of no practical value. Even after profits were earned, the amount set aside for depreciation must depend upon the question of whether the works were maintained efficiently out of revenue. Again, a good deal depended upon the terms of purchase, and in this instance there was the full life of 42 years, after which the Company were to be purchased on the "then value;" and it was to the Company's own interest, under the circumstances, to maintain their undertaking efficiently out of revenue. Another factor in this instance why large sums were not necessary for depreciation was that the Company did not own a generating station—the bulk of their property consisting of mains which did not depreciate at all. In fact, it had often been found that mains appreciated in value after they had been laid a number of years, inasmuch as the insulation resistance was found to improve. He did not know of any case in which an Electric Lighting Order had been rejected on account of gas competition.

This completed the case for the Bill.

Mr. *Lomas*, the Clerk to the Rickmansworth Urban District Council, gave evidence in support of their petition against the Bill, and expressed the opinion that the Company were not in a sufficiently financially sound position to undertake this extension, even if a supply of electricity were needed in the district. As a matter of fact, however, there were very few houses which could be supplied—most of the area being grass lands at present. Furthermore, the Company a few years ago had been unable to raise capital for developing a Provisional Order for Pinner, Stanmore, and Edgware, which it held, and the Order was abandoned. The Rickmansworth Council had laid mains wherever there was thought to be a likely demand in the area now proposed to be added to the Electric Light Company's limits of supply; but they had lost money upon this. Only thirteen houses had been built in the area in seven years.

Mr. *C. A. Marsh*, a chartered accountant, said that he had examined the Company's accounts, but had not formed a very high opinion of their financial status. The amount set aside for depreciation was less than 1 per cent., whereas for the London Electric Light Companies it was 2¾ per cent. There was little prospect of the Company making a profit out of the district, and, being such a small undertaking, there would be a very great difficulty in raising capital—in fact, 15 per cent. had to be paid some time ago for the underwriting of an issue of debentures.

In cross-examination, Mr. TYLDESLEY JONES pointed out that, in arriving at the average of 2¾ per cent. for the London Companies, Mr. Keen had taken the amounts set aside for reserve as well. Witness stated that taking the average allowed for the fact that many companies did not set aside so much as 2¾ per cent., while others put aside more.

Mr. *W. H. Patchell*, Consulting Electrical Engineer, also gave evidence in support of the Council's opposition, and expressed the opinion that there was no prospect for many years to come of an electric lighting undertaking being profitable in the proposed added area. He thought it was best for the Company to continue to make applications to the Board of Trade under section 6 of the Electric Lighting Act of 1909, to supply individual houses as the demand arose.

Mr. POLLOCK, on Friday morning last, addressed the Committee on behalf of the Rickmansworth District Council, and explained that, as a gas authority pure and simple, they would not have opposed the Order. The Council, however, held the opinion that if there was to be any development in the area it could only be by adding it to the Rickmansworth urban district, in which case it was only right that the Council should be the electric lighting authority. In any event, it was clear from the evidence that the Company were not in a position to assist the district; and in so far as applications were made by the owners of individual houses for a supply of electricity from the Company, there was the Electric Lighting Act of 1909, which was expressly drafted to meet such cases.

The Committee, without calling on the promoters to reply, decided that the Order should be confirmed.

LEGAL INTELLIGENCE.

PERIOD FOR THE RECOVERY OF WATER-RATES.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Monday, June 9.

(*Before Lords Justices* VAUGHAN WILLIAMS, BUCKLEY, *and* HAMILTON.)

Metropolitan Water Board v. Bunn.

This was an appeal by the defendant from a decision of the Divisional Court, consisting of Justices Ridley and Scrutton, that the case should be sent back to the County Court Judge to hear and determine it, with the expression of the opinion of the Court that the six months' limitation for the recovery of water-rates did not apply. The proceedings in the Divisional Court were reported in the "JOURNAL" for Dec. 3, 1912 (p. 771).

Mr. MACMORRAN, K.C., for the appellant, quoted the cases of *Tottenham Local Board v. Rowell*, *Mayor of Leeds v. Robshaw*, and *Vestry of Hammersmith v. Lowenfeldt*, and argued therefrom that the six months' limitation applied in the present case. He said the learned County Court Judge (his Honour Judge Woodfall) had decided that the claim of the Water Board was barred by reason of the lapse of time—*i.e.*, six months; that this decision was reversed by the Divisional Court; and that he now asked the Court to restore the judgment of the County Court Judge. They were dealing with water-rates, of less than £20; and the only remedy for the recovery of such rates was a summary one to which the six months' limitation applied.

Mr. GIVEEN followed on the same side.

Mr. CLAVELL SALTER, K.C., for the respondents, argued that the Board had a right, under section 4 of the Water Companies (Regulation of Powers) Act, 1887, to sue the defendant; that the defendant owed the first six quarters' rates by virtue of her successive ownership, though the rates had become due in the time of her predecessor; and that such rates became a charge upon the house without prejudice to the other remedies of the Board. He quoted the decision in the case of the *East London Water Company v. Kellermann*, which was that the effect of section 4 was that the purchaser of a freehold dwelling-house was liable to a personal action to recover arrears of water-rate which accrued due before the date of the purchase. He argued that it would be a strange result if a personal action were limited to six months, while an action to enforce a charge was not so limited. He asked the Court to uphold the decision of the Divisional Court.

Mr. MACMORRAN, in reply, said that under the Public Health Acts there was a remedy given against the owner of a house, which must be enforced within six months. But, besides this, the Acts placed a charge upon the premises.

Lord Justice BUCKLEY: The point is whether the six months in section 11 of the Summary Jurisdiction Act applies to an action brought under section 21 of the Act of 1863.

Mr. MACMORRAN: Yes, as to the first part of the claim.

Tuesday, June 10.

In giving judgment to-day, their LORDSHIPS expressed the opinion that, if by Statute the remedy to enforce a certain right could be only sought in a defined jurisdiction, and within a defined limited time, then, except in that jurisdiction and within that time, the right could not be enforced. After that time had elapsed, the right remained, but the remedy had gone. If a subsequent Statute provided that the right might, at the option of the plaintiff, be enforced alternatively in another jurisdiction, it was a question of construction of the words of the Statute whether, in the case where the remedy in the first jurisdiction had expired by lapse of time, that in the second jurisdiction had expired also. In the Tottenham case, the question was as to the construction of section 24 of the Local Government Act, 1858, Amendment Act, 1861. This section was so expressed as to convey, by the word "option," that the proceedings there mentioned might be those which could, at the option of the local board, be taken either in the jurisdiction originally named or in the County Court. If, by effluxion of time, there was no possibility of taking the former, there were not two proceedings between which to exercise this option; and it resulted that if the former lapsed the latter became impossible. In the present case, the enactment as to the different jurisdictions which might enforce the right were all contained in the Metropolitan Water Board (Charges) Act, 1907. As regards the last two quarters, the question was expressly covered by previous decisions of the Court of Appeal; and therefore the appeal failed, irrespective of the grounds as to the first six quarters. As regarded these, the matter stood as follows: By section 4 of the Act of 1887, liability was imposed upon the defendant, because it made the claim recoverable from the owner in the same manner as water-rates might by law be recovered. This was a liability imposed for the first time upon the owner; and though it was imposed by only one Statute, it was done by importing successive Statutes. Enforcement against the owner must be made as provided by these Statutes, whatever was their true construction. In the present case, the right to recover was to be in the same manner as any damages for the recovery of which no special provision was made, were recoverable. By section 11 of the Summary Jurisdiction Act, 1848, the complaint was to be made and the information laid within six months from the time when the complaint arose. Then section 21 of the Water-Works Clauses Act, 1863, provided a right to recover in any court of competent jurisdiction, in addition to other remedies for the recovery of demands. There was nothing to bring the present case within even the neighbourhood of the Tottenham case. There was a substantive enactment that a particular right might be enforced in a particular court, with no words limiting the time, though, of course, the Statute of Limitations would apply generally. For these reasons, the Court were of opinion that the decision of the Divisional Court was right, and that the appeal should be dismissed, with costs.

MISCELLANEOUS NEWS.

LONDON COUNTY COUNCIL AND GAS TESTING.

Forfeitures for Deficient Illuminating Power—Tests on Good Friday and Christmas Day.

The Public Control Committee of the London County Council will present, at the meeting of the Council to-day, the following report relating to the testing of gas.

The reports of the Council's gas examiners showed that there had been a deficiency of illuminating power in the gas supplied by the Gaslight and Coke Company at the undermentioned testing-stations on the dates named: Lambeth Road, Nov. 7, 1912; Vinery Villas, Feb. 15 and 17 and April 14 and 15, 1913; Kingsland Road, March 24, 1913; and Carlisle Square, March 20, 22, and 24, and April 21, 22, and 23, 1913. In each case the Company lodged an appeal, and the cases were heard by the Chief Gas Examiner on May 8, 1913; his award being issued on May 30, 1913. A forfeiture of £50 has been incurred in each case in respect of the supply of gas of deficient illuminating power at Lambeth Road on Nov. 7, 1912, and at Vinery Villas on April 14 and 15, 1913; and it has been decided that the reports concerning Carlyle Square for April 21, 22, and 23, 1913, must stand, the Company thereby incurring a forfeiture of £2. The reports concerning Vinery Villas for Feb. 15 and 17, 1913, were cancelled, and that of Kingsland Road for March 24, 1913, amended. In the three remaining cases, which dealt indirectly with the question of tests on Good Friday, the appeals were withdrawn at the hearing. The amount of the forfeitures—£152 in all—is payable to the Receiver of the Metropolitan Police District. In this connection, we may add that it has been the practice for tests for illuminating power not to be made on Good Friday and Christmas Day, as these days were looked upon as being in the same light as Sunday; but we have now arranged that in future tests shall be made on these days.

NOTTINGHAM GAS EMPLOYEES' THREATENINGS.

Methods of so-called "peaceful picketing" were revealed in their true light in a prosecution instituted at Nottingham last Tuesday, arising out of incidents connected with the strike—or, as the men persist in describing it, the "lock-out"—of tinsmiths at the Corporation gas-meter repairing shops. Trade unionists who had sought shelter themselves behind that much-abused formula found that the authorities were in no mood to countenance a degree of licence which fell little short of tyranny. For weeks since the dispute has been in progress, there have been witnessed daily in the neighbourhood of the Woodborough Road gas depôt angry demonstrations, having for their object the intimidation of Mr. James Mooney, the foreman of the shop, and the workman who had chosen to remain loyal to the terms of service. It had required the constant vigilance of uniformed police, and detectives detailed for special duty at the depôt, to prevent unrestrained vituperation degenerating into scenes of open violence, with the result that, when the whole process of intimidation was laid bare, the recalcitrants sought to shelter themselves behind the stereotyped excuse that they had acted in accordance with the general law, as laid down in cases of trade union disputes.

Six defendants were involved; the case against Walter Towle being taken as a typical one. Two sets of information were laid against each of the defendants under the Trade Disputes Act of 1906; they being charged with following Mooney from place to place on various specified dates, and, alternatively, with following him in a disorderly manner. The evidence revealed the presence of a menacing crowd assembled on many occasions outside the shop to await the appearance of the foreman, who had to be escorted to his home daily. Towle was also shown to have used offensive epithets towards the complainant. Mooney, whose only offence seems to have been that he was desirous of getting as much work done by the Corporation employees as was accomplished in a given period by men engaged by private firms, was also met by the oft-repeated cry: "You are a nigger driver." It was palpably too mild a view of the situation to accept the defending solicitor's placid suggestion that the whole occurrence represented indulgence in a spirit of innocent jollification. The police attitude in regard to the matter was defined by the Deputy Chief Constable, who emphasized the reluctance which was always felt to interfere in a trade dispute, but said it was impossible to ignore the exceptional incidents involved in the present instance. The object of the attempt to draw from the witness information as to who was responsible for authorizing the application for the issue of the summonses was pretty clear. The suggestion apparently underlying the questions put in cross-examination was that the Gas Committee had been in some way concerned; but the Deputy Chief Constable preserved strict official regularity by his reply that the Chief Constable had initiated the proceedings, and that beyond this it was not necessary to go for the purpose of the case. The Magistrates (Mr. F. J. Bradley and Dr. J. T. Dabell), both former members of the Corporation, adopted the moderate course of binding Towle over in his own recognizances in the sum of £5 to be of good behaviour for six months; whereupon the other five defendants, acting on legal advice, tendered a plea of guilty, and were similarly bound.

The procedings have had the desired effect, for a time, of putting a stop to the noisy demonstrations in the neighbourhood of the shop; but the heat engendered by the dispute has been abundantly manifested in other directions. The spirit of unrest has throughout been assiduously stimulated by threats of extension of the trouble in quarters affecting the work generally in the Gas Department. Finding the Gas Committee in no mood to acquiesce in unreasonable demands, the next step, according to the pre-arranged plan, has been to invite the whole body of the Council to exercise the functions of a Court of Appeal. The demand upon the Mayor for a special meeting of the Council has been forthcoming from a representative gathering of trade unionists,

when the Town Clerk's letter embodying the Committee's decision was read; regret being expressed at the refusal to accept the suggestion made by the men's deputation, which it was urged might have reasonably been acted upon without any loss of dignity, and would have been an easy means of settling the dispute. Typical of trade union methods, the pronouncement, however, conveniently ignores the main consideration, which amounts to this—whether the Gas Committee are to be the authority exercising control within its own department, or to be under the dictation of representatives of certain sections of organized labour. The Committee have left the door open for the resumption of work, upon terms which appear to be eminently reasonable; and if those responsible for the present agitation persist in the refusal to accept nothing short of the sacrifice of a non-unionist employee as a means of settling the trouble, it is difficult to see how the Council's compliance with their demands can stop the general application of the trade union doctrine to other departments of municipal activity.

The "wire-pullers" evidently intend that the propaganda shall not be limited to the efforts of the National Amalgamation of Sheet Metal Workers and Braziers. There has long been a threat of involving, in the trouble, if necessary, others connected with the Gas Department; and to this colour has been lent by frequent visits which have been paid to Nottingham of late by Mr. Will Thorne, M.P., the General Secretary of the Gas Workers' Union. Arrangements have been made locally for a pretentious demonstration under the auspices of the Union; and the General Secretary is to be accompanied upon the occasion by Mr. J. R. Clynes, M.P., the President of the organization. The proceedings will represent the twenty-fourth anniversary of the establishment of the union; and it is indicative of the importance which is attached to the questions now under discussion locally that Nottingham has been selected for the commemoration, which is to be attended by the District Secretaries representing London, Leeds, Birmingham, South Wales, and Scotland.

Any faint hope which had been entertained that the men might be inclined to adopt a more pacific view regarding the dispute, was doomed to extinction by the issue on Friday of a further pronouncement by the responsible officials of the National Amalgamation of Sheet Metal Workers. Bearing the signatures of Mr. Charles Gordon, the General Secretary, and Mr. Charles Smith, the Secretary of the Wolverhampton district, an official document was forthcoming relating that the matter had been fully considered at a meeting attended by officers from the districts directly interested; the result being the unanimous adoption of a resolution declaring that under no circumstances would the men return to work, unless Spencer either joins the Society or is removed. Thus it would appear that the door has been effectually bolted and barred against any possible *rapprochement*, unless the somewhat doubtful contingency is realized of a settlement through the medium of the suggested special meeting of the Council. Incidentally, the dispute, as generally happens in regard to trade union troubles, has involved in temporary loss and inconvenience some innocent people, who were no parties to the controversy; these being represented by two large outside firms engaged in the meter manufacturing trade in Nottingham. Both were under contract with the Corporation to execute repairs; but, in view of the situation created at the Corporation depôt, the men refused to touch the work, and, declining to submit to any pressure in the matter, left the private shops many weeks ago. In the interest of the firms who have been the helpless victims of the upset, the National Amalgamation has now raised the ban. The further significant circumstance (to which the document makes no specific allusion) remains, however, that meanwhile the boycott upon the repair of Nottingham meters has been extended to the whole of the districts in Great Britain in which the amalgamation exercises trade union domination—a condition of affairs which appears oddly at variance with the boasted freedom underlying insular arrangements.

HEREFORD CORPORATION GAS UNDERTAKING.

Higher Profits—Increase in the Manager's Salary.

The report of the Gas Engineer and Manager of the Hereford Corporation (Mr. W. W. Townsend) for the year ended the 31st of March was presented to the City Council at their meeting on the 6th inst. In the course of it, he furnished the following particulars.

The consumption of gas continues to increase, and the output now exceeds 150 million cubic feet; the extra quantity sold in the past twelve months having been 4,655,340 cubic feet. The ordinary and slot consumers and the public lamps used more gas; but for power and under contracts less was burnt—the last being due to economies effected by the railway companies. The yield of gas per ton of coal carbonized fell off; but the average make for the year was 11,593 cubic feet, compared with 11,750 cubic feet in 1911-12. There were 663 tons more coal used; and this produced a larger quantity of residuals. Coke brought in a net revenue of £4359, or £366 more than before; tar £1126, or £270 more; and sulphate £1579, or £59 more.

Most of the items of expenditure show decreases notwithstanding the increased make of gas; but repairs of mains and services cost £37 more (a large amount of work having been done during the year), and rates and taxes are £115 more.

On the credit side of the account, the extra sale of gas produced an increased revenue of £123 from ordinary consumers and £537 from slot consumers; but the additional quantity of gas used in the public lamps brought in no return—the Gas Committee having decided to improve the lighting without raising the charge. The increased consumption for this purpose is due to high-pressure and two-burner lamps in some of the principal streets, and to the earlier lighting of the lamps during the winter months. The income from fittings has reached the record figure of £3037; but the net profit, after allowing for depreciation on stock, is less than last year, owing to the heavy increases in the cost of nearly all materials. There is a decrease, too, in the amount received from the hire of cooking-stoves, owing to the concession made to slot consumers. Mr. Townsend draws attention to the large increase in the number of hired fires, cookers, and other appliances; and, in addition, a large number have been sold outright. He thinks that with coal at its present prices, and gas at 2s. 3d. per 1000 cubic feet, there will probably be further increases in the consumption of gas, as the public realize more fully the many uses to which a clean fuel, such as gas, can be put, and the advantage of being able to obtain heat, as and when required, by simply turning a tap.

Mr. Townsend points out that, unfortunately, most of the economies he is able to effect in the manufacture of gas are swallowed up by the continual increase in the price of coal. He says the current year will have to bear the increase on last year's contracts up to October; and after that a still further rise of about the same amount, because the new contracts will not be made at less than 1s. per ton advance. The current year will therefore show a very decided falling-off in profits; but he assures the Committee that no effort will be spared to improve the results, if possible, and effect economies.

He concludes by giving the principal figures for the past year in comparison with those for 1911-12.

When the report came before the Council, Alderman Witts, the Chairman of the Gas Committee, said he proposed to defer till a future meeting any remarks upon the accounts, as there was another matter—viz., a recommendation to increase the Gas Manager's salary by £50 per annum as from the 25th of March last—to be considered. He said that in Mr. Townsend they had a gas manager of the first rank. By way of emphasizing the good results of his work, he pointed out that the amount they received in Hereford per ton of coal carbonized was 10s., which last year realized £7000. He compared this with other towns, where the amounts received were only 6s. 8d., 7s. 11d., 8s. 2d., and 8s. 4d. The Committee unanimously voted for the increase, though he pointed out that Mr. Townsend had not himself asked for one. But they felt it would be an act of justice that he should be compensated for his good work. Objection was raised to the advance on the ground that a maximum should be put upon salaries; and that the granting of the suggested increase would lead to applications from other officials. Eventually, however, the recommendation was agreed to.

BURY GAS-WORKS RESULTS.

The minutes of the Gas Committee which were submitted at the last monthly meeting of the Bury Town Council stated that it had been resolved that the price of gas for the ensuing twelve months be a uniform charge of 2s. 3d. per 1000 cubic feet to consumers in the borough (except the added areas), and 3s. per 1000 cubic feet to consumers in the added areas and outside the limits of the borough, subject to the following discounts for prompt payment: Gas used for lighting and heating, 1d. per 1000 cubic feet; gas consumed for motive power and manufacturing purposes: For consumers using 100,000 cubic feet a quarter, 3d.; exceeding 100,000 cubic feet, but not exceeding 500,000 cubic feet, 5d.; exceeding 500,000 cubic feet, 7d. These prices to be subject to a further reduction of 3d. per 1000 cubic feet allowed from the amount now standing to the credit of the gas consumers. Consumers using prepayment meters to be allowed 33 cubic feet of gas for 1d.

Mr. S. Kay, in moving the adoption of the minutes, gave some particulars of the financial results of the past year. He said the twelve months' working showed a net profit of £10,655, out of which £938 was carried to the reserve fund account, and £700 was utilized to establish an insurance fund; leaving a balance of £9017, which was divided between the rates and the gas consumers. The expenditure for the year showed an increase of £3000. Coal had cost £2000 more than in the previous year. The income exhibited an increase of £4300. Gas sales produced £1300 more, and residual products £2700 more. There were 385 cookers, 475 grillers, and 278 boilers, besides numerous fires, gas-irons, &c., fixed during the year. Many thousands of consumers were availing themselves of the great convenience of these cookers, &c. The price of gas for the year was 1s. 11d. net in the borough, and 2s. 8d. net in the added areas. For gas-engines and manufacturing purposes, the prices had been 1s. 5d. to 1s. 9d., according to consumption. Since 1900. £103,437 had been made in profits; one-half of which had gone to the relief of rates, and the other half back again to the gas consumer, in reduction in price of gas, which had averaged 1s. 11½d. net for lighting and cooking purposes. Comparing the year 1900 with 1913, revealed some interesting figures. In the year 1900, the gas used in the borough totalled 292,000,000 cubic feet; in 1913, it was 298,686,000 feet. The gas used in the added areas in 1900 was 17,377,000 feet; in 1913, 24,985,000 feet. The gas used through prepayment meters—and these were rather surprising figures—was in 1900, 12,400,000 feet; in 1913, it was 66,000,000 feet. The total gas used for all purposes in 1900 was 350,000,000 cubic feet; whereas in 1913 it was 420,000,000 feet—or an increase of 70,000,000 feet. The outstanding capital was, in 1900, £150,000; at the present time it was £125,000. He thought they would agree that this was certainly a satisfactory balance-sheet, and that they ought all to be proud of their gas-works and the Manager (Mr. Henry Simmonds).

Alderman Ashworth, in the course of a strong plea for cheaper gas, to do away with the smoke nuisance, said that in giving back half the profit to the rates they were taking from the poor consumer and shopkeeper, and making a present to the large and wealthy ratepayers. He urged the use of electricity for lighting, and the making of a cheaper form of gas for heating and power purposes.

Mr. Kay, in reply, said he considered it a legitimate arrangement by which one-half of the profits went to the rates and the other half was returned to the consumers.

Hebden Bridge and Mytholmroyd Gas Supply.—The profits from the supply of gas by the Hebden Bridge and Mytholmroyd Gas Board during the past year suffered heavily from the increased cost of coal and repairs, &c.; for while a sum of £1324 was realized in 1911-12, last year's working only produced £43. Coal cost £300 more, repairs amounted to £725, and extra interest and repayment charges on capital accounted for £480. The total quantity of gas manufactured increased by 2,623,000 cubic feet.

CONDITION OF THE NEWRY GAS UNDERTAKING.

Local Government Board Inquiry.

Mr. P. C. Cowan, M.Inst.C.E., Chief Engineering Inspector of the Local Government Board for Ireland, held an inquiry last Wednesday into an application by the Newry Urban District Council for a loan of £700 for the improvement of the gas-works.

Mr. *Charles Reilly*, the Gas Manager, having explained that a loss of £800 on the undertaking during the past year was attributable to defective gasholders and leaky mains,

Mr. *Isaac Carr*, M.Inst.C.E., the Consulting Engineer to the Council, said there had been an unaccountable waste of gas to the extent of 36·2 per cent. of the quantity produced. There had also been a serious loss in connection with residuals. Part of the £700 would be spent in repairing the holder.

The INSPECTOR said he did not hold out much hope of the Council getting money to repair a gasholder; and he asked Mr. Carr whether he thought the undertaking a successful one. Witness replied that he was most dissatisfied with it as a department.

The INSPECTOR: It is a very grievous story. It is evident a great change is necessary with regard to the working of the place. Newry ought to have a very successful gas undertaking, and people ought to get the gas much cheaper if the concern were managed in a more businesslike way.

Witness mentioned that the production of tar for the past year was only 7·1 gallons per ton of coal carbonized, whereas it should have been 10 gallons; and a large quantity in stock had not been taken into the accounts, which would have left the concern £100 better off. The quantity of sulphate of ammonia per ton of coal carbonized should be not less than 20 lbs.; but last year it was only 4·9 lbs., and for the previous years 5·9, 10·7, 13·6, 11·7, 11·4, and 14·6 lbs.

The INSPECTOR remarked that it would be a good thing for the ratepayers to get rid of the works if they could not be managed in a more satisfactory way. There was nothing in which skilful management paid better than gas-works. The management at Newry wanted a good shaking-up; and he was afraid he could not hold out any hope that the loan would be granted. The money required would have to be obtained by public subscription or by levying a rate.

DEVONPORT GAS UNDERTAKING.

Deficit on Last Year's Working.

Much disappointment has been caused at Devonport by the result of the past year's working of the gas undertaking, and the fact that, in spite of a largely increased consumption, the accounts show a rather serious deficit. The result was not altogether unexpected; the recent action of the Gas Committee in recommending the appointment of Mr. Isaac Carr as Consulting Engineer, and the reasons given for it at a private meeting of the Town Council, having prepared the members for an adverse report. Nevertheless, the matter gave rise to considerable discussion at the meeting of the Council last Thursday, when the yearly report was presented. The administration of the gas undertaking having been in the past a thorny subject, there was some recrimination about it now.

From the accounts presented by Mr. H. J. Hoare, the Borough Accountant, it appeared that the revenue for the year was £76,290, of which £50,343 was from the sales of gas, £7037 from the rentals of meters and fittings, and £16,736 from the sales of residuals. The gross profit was £16,368; and after paying interest and sinking fund for the year, there was a loss of £3490. This was taken from the reserve fund, reducing the balance on this account to £6354. The quantity of gas made was 442,908,000 cubic feet, as compared with 404,312,000 cubic feet; the make per ton of coal carbonized being 10,512 cubic feet, as against 10,946 cubic feet. The sales of gas were 424,236,530 cubic feet, an increase of 9·1 per cent. on the preceding year. On the other hand, coal cost an average of 15s. 1·82d. per ton, as against 12s. 11·87d. The price of gas was the same in both years—2s. 4d. to ordinary consumers and 3s. 1d. for slot installations. An analysis of the accounts shows that the gross cost of the gas last year was 2s. 7·63d. per 1000 cubic feet, as compared with 2s. 4·72d. in the previous year. After allowing for the revenue from residuals (8·12d.) and rentals of stoves and fittings (4·28d.), the net cost was 1s. 7·22d., against 1s. 4·30d. This brought the gross profit to 9·26d., against 1s. 0·74d.; and after allowing 11·23d. for interest and redemption of debt (against 11·73d. last year), the result was a deficit of 1·94d., against last year's profit of 1 01d. per 1000 cubic feet. The capital expenditure up to the present date has been £325,328, which is equivalent to 15s. 4d. per 1000 cubic feet of gas sold, or £7 14s. 5d. per ton of coal carbonized. There are 61½ miles of main, 6821 ordinary and 12,780 slot consumers, and 2082 stoves on hire. The present number of meters gives 318·72 per mile of main, as compared with 159·24 per mile in 1903—the first year of the Corporation's control of the undertaking.

Alderman TOZER, the Chairman of the Gas Committee, in proposing the adoption of the accounts, said he felt less pleasure in performing this duty than he had in former years, when there had been a profit to declare. Though the result of the year's working would not come as a surprise after the statement he made in Committee two or three months ago, he was bound to say that the Committee were very dissatisfied. Twelve months ago, when he was able to report a profit of £1700, he said that, personally, he was disappointed and dissatisfied with the result of that year's working. When they considered the vast amount of capital involved, and the favourable price of coal and oil, making a paltry profit of £1700, when in previous years they had made several thousands, could only indicate degeneration in the working. Although the Council seemed satisfied with the fact that a substantial profit had been earned, he did not consider that things were going as they should, and he caused an interim report to be made, while every one of the Committee had tried to discover the difficulties and have them remedied. The gross profit for the year 1912-13 was £16,368, against £20,664 for the previous year—a decrease of £4296; and after providing for the capital charges, there was a deficiency on the year's working of £3491. The make of gas had been the largest in the history of the undertaking. Of coal gas, they produced 297,722,000 cubic feet, and of water gas 145,186,000 cubic feet, or 67·22 per cent. of coal gas and 32·78 per cent. of water gas. In the previous year, the quantity was: Coal gas, 297,912,000 cubic feet, and water gas, 106,400,000 cubic feet, or 73·68 per cent. and 26·32 per cent. respectively. The sales of gas for the year were no less than 35,253,392 cubic feet in excess of the previous twelve months. So far as it went, this increase was very satisfactory; but it only made the financial result more unsatisfactory. In the opinion of the Committee, the deficiency could be attributed to two causes—one unavoidable and the other avoidable. The unavoidable cause was the great increase in the cost of coal and oil, and of almost everything which they had to purchase. It must not be thought that the plant was in a degenerate or poor state because the Committee were asking the Council to make further expenditure in accordance with the suggestions of Mr. Carr, their Consulting Engineer. So far as it went, the plant was most satisfactory, and practically new. The additional expenditure was needed to meet the enormous increase in the demand for gas, which the present retorts were incapable of meeting. With oil at its present price—its cost had practically doubled—it would be waste of money to endeavour to increase the supply from the water-gas plant. The primary source of the revenue of the undertaking was in the production of gas. During the past year, for every ton of coal carbonized there had been a decrease in the yield of gas as compared with last year of 434 cubic feet. This meant that to produce the same quantity of gas as last year they had to carbonize 1672 tons of coal more, which cost £1267. The Committee felt that the additional expenditure was caused by defective working. It could be brought about in no other way. They were not demanding a greater yield of gas than was made in many other gas-works; and under proper management that £1267 should be at the credit of the undertaking today. Residuals were almost as important as gas. During the past year, there had been a deficiency in the production of coke of ⅝ cwt. per ton of coal; so that for the same quantity of coal carbonized as in the previous year they had 948 tons of coke less to sell, which, at the average price during the year, meant £765. In 1911, when they had a greater quantity of coke, the cost of handling was 6d. per ton; whereas last year it worked out at 1s. 1¾d., which, on about 12,000 tons, represented an extra expenditure of £408. As to sulphate of ammonia, he had taken the average production of other municipal gas undertakings, because he thought that would be fairer than taking those under private management. He found that the average production was 22 lbs. per ton of coal carbonized; while unfortunately they had at Devonport only 19½ lbs. The difference represented 31 tons, or a loss of £428; so that if they only had the average of other corporations, they would be £428 better off. In the matter of tar, he had compared their production with that of 77 undertakings under corporation control, and found that at Devonport they produced 3 gallons less than the average. This meant 472 tons, or £543. Since the gas-works had been under the control of the Corporation, they had given the Committee full power of expenditure where they thought it necessary for improvements; and they had spent the money in the hope that it would be recouped. They had practically a new plant; and they were not asking too much of their officials in charge in expecting that their production should be at least equal to the average of other corporations. If they had had this average production, they would have been £3411 better off. In the purchase of coal for the coming year, they were faced with an additional expenditure of £2478. On the other hand, one of the loans would fall in, which would relieve the charges to the amount of £1700, and they would also have a saving on the contract for automatic installations. These advantages, of course, ought not to go to make up a deficiency, but should be to the credit of the undertaking and enable them to reduce the price of gas. In Plymouth the price of gas had been increased; and though he had every confidence that they would not have to increase the price in Devonport, something would have to be done. They had every confidence in Mr. Carr, whom they had appointed to guide and assist them. The Committee knew there were glaring defects, and they would be prepared to take any drastic measure in the interests of the undertaking to ensure its future success.

Mr. BAXTER expressed sympathy with the Gas Committee; but criticized the quality of the gas.

Mr. GEORGE, referring to the purchase of coal, asked if it was true that one member had bought 20,000 tons on his own responsibility. He also questioned the wisdom of some of the appointments at the gas-works, and said that if men were to be placed there at first by one person and then by another, against the wishes of the Manager, they could not expect to get the best out of the undertaking. The Committee should give the Manager full control.

Mr. JARVIS: He has always had it.

Mr. MOSES thought the difficulty was due in large measure to the trouble experienced in getting the right kind of coal. No engineer, however capable, could get out of the coal what was not in it. Owing to labour troubles they had had to pay higher prices for coal of inferior quality. The Engineer had been using coal capable of producing only 8000 cubic feet of gas per ton; while now they had coal from which it was possible to produce 11,000 cubic feet.

Alderman HORNBROOK, a former Chairman of the Gas Committee, said he could not hold that Mr. Tozer was responsible for the present condition of affairs.

Alderman TOZER, in reply to the various speakers, said he could not agree that the quality of the gas was worse than formerly. It was much better. In regard to the coal contracts, it had been said outside the Council that he had gone away and bought 20,000 tons of coal. What happened was that they had various tenders of coal, and the lowest was 17s. 9d., against 13s. 11d. under the previous contract. It was thought that some reduction might be got, and as he was in London he called on the firm who tendered, and obtained an offer to reduce the price to 17s. 4d. per ton if an order for 30,000 tons was placed. This was submitted to the Gas Committee, who declined it and decided instead to take 15,000 tons at 17s. 7d.

WEST BROMWICH GAS UNDERTAKING.

Report of the Engineer.

In the "JOURNAL" a fortnight ago (p. 687), a few figures were given from the annual report of the Borough Treasurer (Mr. H. Kirk) with regard to the financial operations of the West Bromwich Corporation Gas-Works for the year ended March 31. The salient points were dealt with subsequently by the Chairman of the Gas Committee (Mr. J. Brockhouse), when the accounts were before the Town Council—*ante*, p. 756. These references may now be followed by some particulars from the report of the Gas Engineer (Mr. Harold E. Copp).

Mr. Copp states that the cost of maintenance of works during the year amounted to £4103, compared with £4326 during the previous year. The repairs and maintenance of stoking machinery and electric generating plant amounted to 0·6d. per ton of coal carbonized, compared with 1·18d. during the previous year. The number of units generated was 10,727. The gas used on the works amounted to 6,147,600 cubic feet, compared with 5,861,000 cubic feet the previous year.

Carbonizing wages amounted to £2917, or 1·82d. per 1000 cubic feet of gas made, compared with £2317, or 1·52d. per 1000 feet made, during the previous year. The increase was due to the fact that the advances in wages granted in November, 1911, applied to the whole of the past year, but to only five months of the previous year. The coal carbonized during the year amounted to 32,481 tons (including 1840 tons of cannel), yielding 372,884,000 cubic feet, or 11,480 cubic feet per ton. The cost of coal used during the year was £24,087, against £18,643 during the previous year—the market price of gas coal having considerably advanced. It was also to be regretted that a further advance had already taken place, which would affect the current year's working.

The cost of water-gas manufacture was £664, or 14 89d. per 1000 cubic feet, compared with £2508, or 12·27d. per 1000 feet, the previous year. The quantity of water gas made was 10,696,000 cubic feet, or 2·78 per cent., compared with 49,045,000 cubic feet, or 13·4 per cent., the previous year. The price of gas oil renders the cost of the manufacture of water gas prohibitive; hence the smaller quantity made.

The total quantity of gas made during the year was 383,580,000 cubic feet. The average calorific power was 615 B.Th.U., and the average illuminating power 15·28 candles, compared with 613 B.Th.U. and 15·59 candles the previous year. As predicted in his last annual report, he was pleased to record an almost entire absence of trouble due to naphthalene—a portion of the old cyanogen scrubber being used for the extraction of superfluous naphthalene.

The total wages at the works amounted to £7074, or 4·43d. per 1000 cubic feet, compared with £6114, or 4·01d. per 1000 feet, the previous year. A large proportion of the increase was due to the high rate of wages already referred to. The total manufacturing charges were £36,967, compared with £32,488. The coke produced amounted to 20,215 tons, against 16,293 tons. The yield of tar was 10·81 gallons per ton of coal carbonized, and of ammoniacal liquor 30·80 gallons, compared with 10·7 and 30·7 gallons respectively. A new process for the extraction of cyanogen had been adopted in place of the ammonium sulphocyanide process, which had been in use during the past few years; the cyanogen now being recovered in the form of sodium ferrocyanide. Owing to the alteration of the plant, cyanogen was not recovered during the greater portion of the year. From results obtained under the new process (which was started at the beginning of February), substantial profits would in future be derived from this source. The sales of coke amounted to £11,265, as compared with £8194 the previous year.

A complete installation of five settings of vertical retorts, each setting containing four retorts, is in course of construction by the Woodall-Duckham Vertical Retort and Oven Construction Company, at an approximate cost of £18,000. The plant will be capable of producing 1,250,000 cubic feet of gas per day; and the whole process of carbonization, from the discharging of the coal-waggons to the depositing of the coke in the yard, will be entirely carried out by mechanical means. It is confidently expected that the working of the installation (which will be completed about the end of September) will result in much benefit to the undertaking.

Mr. Copp is again able to report an increase in the sales of gas, amounting to 17,566,713 cubic feet, or 4·82 per cent. The prices of gas were reduced to practically all classes of consumers at the beginning of the December quarter, affecting practically two-thirds of the total output of gas. In view of the substantial reductions made, it is, he says, to be regretted that the consumption has not increased in greater proportion; and active measures should be pursued in the near future to bring before consumers the advantages of a fuller use of gas for domestic purposes. The quantity of gas sold per meter installed still compares unfavourably with many other towns—being less than half that of Birmingham.

During the year, a new main had been laid from the gas-works to Union Cross, giving a separate supply of gas to the Great Bridge district; the pressure in this district having for many years been insufficient for the proper utilization of gas by modern means. The cost of this main amounted to £1123. The number of gas-stoves fixed was 137, compared with 130 the previous year; and of gas-fires 71, compared with 51. The number of meters fixed was 310, compared with 237. The number of public lamps is now 1099 (of which 948 are fitted with incandescent burners). The total wages in the distribution department amounted to £2945, against £2701. The unaccounted-for gas amounted to 19,013,313 cubic feet, or 4·95 per cent. compared with 17,629,426 feet, or 4·82 per cent. The use of high-pressure gas is rapidly gaining in popularity; a large number of high-pressure lamps having been supplied during the year. An extension of the compressing plant at the High Street has been carried out; and it is now capable of fully meeting the demand of the public for high-pressure gas during the next winter season.

According to a statement made by the Chairman of the Mid Sussex Joint Water Board (Major J. J. Lister, J.P.), when the water undertaking was acquired the income was £1571; it has now risen to £8638.

LEIGH (LANCS.) GAS AND WATER SUPPLY.

The Gas and Water Engineer of the Leigh (Lancs.) Corporation Mr. James Gibson, has presented his reports on the working of the undertakings under his control in the year ended the 31st of March last. They furnish the following particulars.

The gross profit for the year on the Gas Department was £12,984; being 7·43 per cent. on the capital invested in the undertaking. After deducting sinking fund and interest charges, £9885, equal to 1s. 3·86d. per 1000 cubic feet of gas sold, there was left a net profit of £3099. Out of this certain special charges were paid, bringing down the profit to £2691, which was carried to the net revenue account. The quantity of coal carbonized was 14,192 tons, and 160,179,000 cubic feet of gas were sent out, of which 151,972,000 cubic feet were accounted for. The gas sold for general consumption (including the public lighting) was 149,580,300 cubic feet. Through ordinary prepayment meters, 51,136,600 cubic feet of gas were sold; and through similar meters with corporation fittings, 6,721,000 cubic feet. The coke saleable per ton of coal carbonized was 10·85 cwt.; and the tar, 1·14 cwt. The production of ammoniacal liquor per ton of coal was 2·48 cwt.; the make of sulphate being 25·09 lbs. per ton. The capital invested in the works at the close of the financial year (excluding the cost of the scrubber-washer, exhauster, and carburetted water-gas plant) was £174,778; being at the rate of £12 3s. 8·09d. per ton of coal carbonized, 21s. 9·87d. per 1000 cubic feet of gas made, and 23s. 4·43d. per 1000 cubic feet of gas sold.

The revenue account of the water undertaking shows a loss of £1199, compared with £624 in the year 1911-12. Mr. Gibson explains that the increased deficit is owing to the large decrease in the revenue obtained for water sold per meter for trade purposes. Since no increase in the revenue can be expected from the assessed charges, he says it will be advisable for the Committee to avail themselves of every possible source of revenue—viz., non-payment for closet water by consumers who have meters fixed: the supply through one meter of suites of offices occupied by several persons, &c. The consumption of water per head per day continues to be below the average of most towns. The total quantity of water received from the Liverpool and Manchester Corporations was 263,096,000 gallons, and it was distributed as follows: For trade and domestic purposes by meter, 47,146,300 gallons, at 1s. 4·27d. per 1000 gallons, yielding £3197; supplied to Ashley, 1,029,000 gallons, at 10d., yielding £43; supplied on assessment and for cattle, 214,920,700 gallons, at 7·3d. per 1000 gallons, yielding £6541—making a total return of £9781. The capital invested in the water undertaking on March 31 was £63,783; the capital expenditure to this date under the Leigh Corporation Act, 1903, having been £21,592.

GAS AND WATER SUPPLY IN BARRY.

Conflict between the Council and the Railway Company.

Two Committees of the House of Commons had an interesting question to consider last week concerning the supply of gas and water in Barry so far as the Railway Company's property is concerned; and, curiously enough, both have arrived, quite independently, at a similar decision. The matter first came up for discussion before Section B of the Local Legislation Committee, presided over by Mr. Gardner, on Wednesday, in connection with the Barry Urban District Council Bill, which seeks additional powers in regard to the Council's gas and water undertakings. In the first place, it may be mentioned that the proposals contained in the Bill as originally deposited, for constructing additional water-works, have been withdrawn. But there remain some clauses dealing with the supply of water in bulk; and a 20s. charge is authorized in connection with the use of water for other than domestic purposes where a hose-pipe is used.

As to the Council's gas undertaking, powers are taken for additional lands; and a few other matters are dealt with. All the opposition, however, was with regard to the clauses giving the Council the rights to lay gas and water mains in streets not dedicated to public use; and it was in this connection that the great fight took place between the Council and the Barry Railway Company, who were the only opponents. The position as to the growth and development of the town of Barry is decidedly interesting. When the Barry Railway Company were first incorporated, no town existed; but as the place developed, the Company themselves were compelled to make arrangements for gas and water supply. This led to the formation of the Barry and Cadoxton Gas and Water Company, who took this part of the business in hand. One of the conditions between the two Companies was that the Gas and Water Company should have no rights whatever over any of the Railway Company's railways and docks as regards interference with the roads or for the purpose of laying mains—any supplies of water or gas being provided by the Company. Subsequently, the Barry Council came into existence, and in 1893 purchased the Gas and Water Company; and the stipulation as to there being no rights over the Railway Company's docks and railways was, of course, transferred to the Council. Under the present Bill, however, the Council seek powers to lay mains in streets not dedicated to public use, with the following addition: "Provided that this section does not apply to any premises belonging to the Barry Railway Company and used by that railway as part of their railways or docks." This, however, by no means satisfied the Railway Company, inasmuch as their contention was that the prohibition at present upon the Council was not merely in respect of the Company's railways and docks, but in respect of the large areas of land belonging to the Company upon which many warehouses and factories owned by private persons were erected, and in respect of which the Railway Company had certain powers to supply water and gas. As a matter of fact, the Railway Company do not give a supply of gas, nor do they supply water for domestic purposes. Permission is given for the Council to lay mains from time to time to supply any such works; but the Railway Company claimed the right of veto over all their property, whether technically

it could be said to form part of the railways or docks or was actually land owned by the Company and let for manufacturing purposes.

On the other hand, the Council's argument was that their area of supply was the whole of the urban parish, without distinction as to ownership of the land, and that the prohibition put upon the old Company, who were purchased by the Council, extended only to actual railways and docks and premises of the Railway Company. The Company, it was contended, were developing large areas of land for works and factories, and the private roads constructed in connection with them should be open to the Council for the purpose of laying water and gas mains—at any rate, for the supply for domestic purposes in the case of water—and that the usual statutory powers should apply. Furthermore, the right to lay mains in private streets had been granted in numbers of cases. Moreover, the water supplied by the Railway Company was only fit for trade purposes, such as working hydraulic cranes, &c., and was quite unsatisfactory for domestic uses.

After discussing the point for two days and searching the Acts of Parliament involved, the Local Legislation Committee decided to give the Council the right to break-up private streets, which will, of course, include the Railway Company's property, with the following addition: "Provided that this section shall not apply to any premises belonging to the Barry Railway Company and used byt hat Company as part of their railway or docks, nor, except for the supply of water for domestic purposes, shall it apply to any premises owned or leased by the Barry Railway Company under their statutory powers unless the consent of the Company shall have first been obtained, which consent shall not be unreasonably withheld." In other words, the Committee desire that the supply of water for domestic purposes should be given to all the premises within the confines of the docks, and also gas. The exact drafting of the clause will be settled to-day (Tuesday).

The other Bill in which the same point was discussed was the Barry Railway Bill, in which the Company were seeking to acquire additional lands for the purposes of their undertaking, some portion of which, admittedly, is to be let for the development of manufacturing works. The Committee in this case was presided over by Mr. Soames. Barry petitioned against the Bill, asking to be allowed to lay their mains upon this land. The same evidence and arguments were used; and the decision, although having the same effect as in the case of the other Bill, was given, so to speak, in the opposite direction—*i.e.*, the Barry Railway Company, in respect of this new land, cannot themselves supply water for domestic or trade purposes without the consent of the Barry Council.

Gas Tragedy at Birkenhead.—A worker at the docks at Birkenhead walked into the police station on Monday night of last week, and stated that his wife and three children were dead. The police proceeded to his house, where there was a strong smell of gas. In one of the bedrooms the wife and children were found dead. The gas-bracket had been torn from the wall, and a piece of tube attached to the end of the gas supply pipe.

GAS AND ELECTRICITY SHOW-ROOMS FOR BURTON.

Draft upon the Gas Reserve Fund.

The Burton-upon-Trent Town Council have lately had before them the question of the provision of gas and electricity show-rooms, a museum, and a public lavatory; and at the monthly meeting last Wednesday Alderman Lowe, the Chairman of the Gas and Electricity Committee, moved that a tender of £6650 for the work should be accepted. He explained that the scheme might be divided into five sections—(1) a gas-compressing station and an electricity sub-station in the basement of the building; (2) the lavatory; (3) the caretaker's house; (4) gas and electricity show-rooms, with yard and out-offices; and (5) rooms for a museum. The cost of the compressing station would be £325; of the lavatory, £775; of the caretaker's house, £275; of the show-rooms, £2975; and of the museum, £2300. With regard to the caretaker's house, it was proposed to fit it up with all the latest appliances for cooking and heating by gas and lighting by electricity, in order that their utility might be demonstrated to prospective customers. The cost of the fittings was included in the £275. As to the gas and electricity show-rooms, the cost of which was £2975, he desired to point out that the Council had approved again and again of the principle of having these rooms. For the benefit, however, of those who still entertained doubts as to the wisdom of spending such a sum for this purpose, he would state that the Committee had made wide and exhaustive inquiries as to the advantage which an undertaking like theirs was likely to gain by them; and the results had been absolutely unanimous in showing the great advantages which had been gained wherever show-rooms had been introduced. Having dealt with the proposal to have a museum and art gallery, which had been somewhat adversely criticized, Alderman Lowe expressed his pleasure in submitting it, as he was satisfied that, when it had become an accomplished fact, it would be regarded as a wise and beneficent policy which led the Council to go through with the matter. Coming to the question of the cost, he said the scheme would not put a penny upon the rates. It was true the money would come out of the reserve fund of the gas undertaking; but it would not hasten, nor would it retard, the time when the price of gas would be raised or reduced. The motion to accept the tender was carried *nem. con.*

Referring to Alderman Lowe's statement that the cost of the scheme will come out of the gas reserve fund, the "Burton Daily Mail" last Thursday said: "Why, if the money is not needed by the department, is it not utilized in repayment of debt, plenty of which still hangs around the neck of the Municipality, or distributed either among those who have produced it by the increased rates of recent years, or among the gas consumers, who would welcome still cheaper illuminant? Whether or not this particular scheme adds to the ratepayers' burdens, one fact is indisputable—rates are going up again next March."

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COKE AND GAS MANUFACTURE IN BELGIUM.

Offer of Coke-Oven Gas to the Brussels Municipality.

The Engineering Supplement to "The Times" last Wednesday contained the following particulars respecting the manufacture of coke and gas in Belgium.

A large coke-oven plant on the Semet-Solvay system, with eight batteries of 38 units each and bye-product recovery, is being erected at Vilvorde, on the right bank of the Maritime Canal of Willebroeck. It is designed for a yearly consumption of 600,000 tons of coal; and will, it is expected, be at work in October next.

The main object of the installation is to supply coke to certain blast-furnaces; but, in order to obtain an outlet for the gas yielded as a bye-product, the Company constructing the plant have offered to supply Brussels with about 1½ million cubic feet a day at a price equivalent to 8d. per 1000 cubic feet. The gas would be taken to the existing municipal works at Brussels through a pipe to be laid by the Company. These works are designed for a daily maximum output of 7½ million cubic feet; and as the consumption now at times exceeds 7·4 millions, the question of making extensions is becoming urgent.

By obtaining an additional supply of gas from the coke-oven plant at Vilvorde, the Brussels authorities would save the expenditure, estimated at upwards of 500,000 frs. (£20,000), involved in enlarging their works, and, further, would obtain the gas at a much lower price than at present. It has been calculated that, including the charges for purification and distribution, the coke-oven gas could be delivered at from 1s. 9¾d. to 2s. per 1000 cubic feet, compared with 2s. 8¾d., the price now charged to the public.

HIGH-PRESSURE DISTRIBUTION IN AMERICA.

Some time ago, the Editor of "Gas Age" [New York] wrote to a number of companies for information concerning their high-pressure gas distribution and transmission systems. Of the replies he received, some were given in the number for the 2nd inst.

Sunbury (Pa.).—Mr. Geo. W. Beck, the Superintendent of the Gas Department of the Northumberland County Gas Company, said: "We carry 80 lbs. initial pressure in our storage tanks, reducing it to 10 lbs. upon delivery to the street main system; using house regulators upon services, and delivering the gas to the meter at about 3 in. water pressure. We are using a Blaisdell straight-line compressor at Northumberland, and we have a Clayton duplex compressor at our Sunbury plant. This last-named compressor is on an individual line supplying a local silk-mill, and is operated generally under 30 lbs. pressure. We have not employed any particular method for securing tight joints, other than are usually employed, and have had no trouble with leakage. We have had in the past considerable trouble on account of frost in the high-pressure system, and would advise anyone contemplating putting in such a system to be sure to go below the freezing-line. We have had no particular trouble otherwise."

Faribault (Minn.).—Mr. B. W. Cowperthwaite, Manager of the Consumers' Power Company, wrote regarding the system and plant they installed last season, as follows: "We are at present supplying the town of Northfield (Minn.) from our plant at Faribault, a distance of 14 miles. The line consists of a 2½-inch special pipe fitted with hydraulic recessed couplings. In this line, at intervals of approximately 1000 feet, we placed a special Dresser coupling which acts as an expansion joint. The pipe was laid an average of 2½ feet beneath the surface, and was carefully graded; drips being placed at all low points, and alcohol taps at the summits. An Ingersoll-Rand 8 in. by 8 in. motor-driven compressor compresses the gas to the desired point. The motor, which is a General Electric 10 H.P. motor, is controlled by an automatic starter which cuts in when the pressure on the line has dropped to about 28 lbs., and cuts out when the pressure has reached 45 lbs. The outfit is entirely automatic, and requires practically no attention. At Northfield the gas is delivered to a 20,000 cubic feet holder, where again the control is automatic. Though the line is far from being below the frost-line, no difficulty was experienced last winter from stoppages. The only trouble from leakage was occasioned by the breaking-off of one of the drip-pipes, due to contraction of the line. At present the consumption on this line is about 20,000 cubic feet daily. The service at Northfield is entirely satisfactory."

Flushing (N.Y.).—Mr. M. H. Spear gave the following particulars as to the Long Island lines they operate: "We have two compressors, one of 20,000 cubic feet per hour capacity, which is a Clayton air compressor, and a Laidlaw-Dunn-Gordon, of a capacity of 40,000 cubic feet per hour. We use the larger one on the peak load and the smaller one the rest of the time; and both are giving excellent satisfaction. They regulate the pressure within 4 lbs.; and as we carry 30 lbs. on this line most of the time, it makes it very even. The larger one is fitted with a Meyer cut-off valve. We have had very satisfactory results by using red lead and shellac on the joints, except, of course, in cases where we have used the Dresser couplings; and so far we have had no trouble with these couplings."

Lafayette (Ind.).—Mr. S. T. Murdock, Managing-Director for the Indiana Lighting Company, wrote: "We simply use pressure of about 15 lbs. to pump gas from one town to another; the distance between the towns being about twenty miles on the average. The strictly high-pressure services which are taken off these lines are not enough to give a real line on high-pressure work; but we have very little trouble with the regulators or service in any way, except that occasionally the mercury seal on the regulator blows—due probably to a deposit of scale on the valve, or from a local cause. The compressors we use are the ordinary duplex of the Laidlaw-Dunn-Gordon or Ingersoll-Rand type, neither the gas operated nor the steam power being combined. The joints in the line are depended upon for being tight by simply being made-up with ordinary screw couplings tight at the start, as we do not

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10 a.m. to 6 p.m. daily.

use any expansion joints. We have had practically no trouble in maintenance; the only thing of any moment being small connections, which are made under the mains by means of a saddle for drips. In some cases these have broken loose."

Los Angeles (Cal.).—Mr. C. A. Luckenbach, Manager of Construction for the Los Angeles Gas and Electric Corporation, gave the following brief description of their remarkable high-pressure distribution: "Our high-pressure system consists of 437 miles of genuine, full weight, wrought-iron pipe, from 2 to 12 inches internal diameter. We carry, at times, pressures as high as 60 lbs.; but our usual pressure is close to 40 lbs. With the exception of near the compressor station, all our joints on high-pressure lines are regular screw pipe joints. Near the station, where the gas has not yet been reduced in temperature after compression, we have a number of expansion joints upon the system; but we use no welding outfit of any kind at our joints."

San Diego (Cal.).—Mr. R. L. Clarke, the General Superintendent for the San Diego Consolidated Gas and Electric Company, wrote as follows in answer to the inquiry: "In the past six or seven years, we have distributed a considerable quantity of our gas under what we call high pressure—30 to 45 lbs.—with very good success. The compressors we use are the Hall, Laidlaw-Dunn-Gordon, and Ingersoll-Rand. To secure tight pipe-lines, before the gas is turned into them, we test the lines with air pressure (75 lbs.), letting this pressure stand for 24 hours with only a reduction of 10 lbs. To secure these results, we have found it necessary to remove the coupling on the pipe and reverse it, applying at that time litharge and red lead to the threads. In ordering pipe from the mills, we have the couplings left loose, so that we can make-up the joint ourselves, and not rely on the mill-made joints. We have experienced very little trouble with our high-pressure gas distribution. In most cases we use individual governors for each consumer; but wherever possible we instal one or two governors on a line of low-pressure services, supplying quite a number of consumers. This we consider the best practice; but it cannot always be followed on account of the distance between consumers."

PURIFICATION AND SOFTENING OF WATER.

Paper by Mr. Joseph Parry, M.Inst.C.E.

The members of the Royal Sanitary Institute recently held a sessional meeting in the Town Hall, Chester (where they were spending a week-end), under the presidency of Mr. PERCY BOULNOIS, M.Inst.C.E., the Chairman of the Council of the Institute.

The CHAIRMAN, in opening the proceedings, said a great deal was learned from these sessional meetings, and they awakened the interest in sanitation which was so necessary locally. His duty as Chairman was very pleasant, because he only had to introduce Mr. Parry, who was well known to all in the room as the Chief Engineer of the Liverpool Water-Works, and stood in the front rank of water engineers.

Mr. PARRY read a paper on "Modern Methods for the Purification and Softening of Water Supplies." By means of diagrams, he described his recent practice in slow sand filtration for Liverpool and district, dealing with the grading of the sand, the gravel chamber, drains, control and measurement, and methods of cleansing. He next dealt with the general trend of Continental and American practice in slow sand filters and preliminary or roughing filters, and afterwards spoke of sedimentation. Modern methods of judging the efficiency of purification were next passed under review, and the respective merits and value of chemical and bacteriological results discussed. He spoke of the significance of analysis, paying special attention to work of this kind done in America. He strongly supported the adoption of standard methods of examination and report, and considered the Institute would render valuable service if they could bring this about. The next reference in the paper was to the ozone treatment of the water of the River Maur, which supplies the City of Paris. Mr. Parry concluded by speaking of methods of softening water, giving an interesting account of the newest devices.

Mr. G. W. BENNETT, the Engineer of the Chester Water-Works, opened the discussion. He spoke of the Chester system of filtration, where the six beds have a total depth of 4 and 5 feet of filtrating materials composed of sharp sand with two layers of fine sand interposed. This formation was only adopted after several years of careful experiment, and was found to yield the best results.

Dr. ORR, Medical Officer of Health for Shrewsbury, thought it did not matter what was the quantity of organisms in water, but what the organisms were. He considered that, now that bacteriological examination was becoming standardized, the chief difficulty was the matter of interpretation.

Dr. RENNET (Chester) said the most important advance made in water purification had been the work done in connection with sedimentation. If there was any doubt whatever about the purity of water supply—if, for instance, water was taken from a river where there was a possibility of occasional pollution only—sedimentation ought to be insisted upon. With regard to bacteriological examination, he thought the certificate should give the number and not the percentages of bacilli. He did not think the bacteriological examination of water had been standardized to the extent it might be. Respecting the ozone treatment, they knew it had been extensively employed on the Continent; but he considered it had rather a limited range of usefulness.

Mr. J. WILDING, Engineer and Surveyor to the Runcorn Urban District Council, thought the problem for small country localities was the softening of pumped supplies of water. He suggested that a work of great value would be accomplished if a real study were made of the hardness of pumped water, so that, if possible, the smaller authorities might know how to deal with this difficulty. They would gladly welcome any invention which would soften water in such a way as would not alarm the domestic consumer, and at the same time prove suitable for manufacturing purposes.

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Dr. MEREDITH YOUNG said he was one of those who believed in getting acclimatized to water as one had to do to air; but in the case of water he thought only partial acclimatization was possible. In his experience, the transference of a person from a hard to a soft supply did not do much harm; but the transference from soft to hard, especially a magnesian supply, produced gastric and other internal disturbance. He agreed with Mr. Parry in looking upon mere chemical analysis, or a combination of chemical and bacteriological analysis, with caution. He believed in looking more to the topographical circumstances. He would rather view the *locus in quo* than have half-a-dozen examinations, bacteriological or otherwise. He was of opinion that they ought to get examinations put under a proper scheme.

At the close of the conference, Mr. Parry was thanked for his able paper.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June* 14.

Sulphate of Ammonia.

The moderate level of prices has again attracted attention, and demand has been enough to bring about a slight recovery in values, the closing prices being £12 17s. 6d. per ton f.o.b. Hull, £12 18s. 9d. per ton f.o.b. Liverpool, and £13 per ton f.o.b. Leith. There has been a moderate amount of direct buying, but the market has had to depend mainly upon requirements for covering contracts for the month's delivery. For delivery ahead, the large makers have for the most part maintained a firm attitude; but business has been done for the near months at a premium of about 3s. 9d. per ton on spot prices.

Nitrate of Soda.

This market is again easier, and spot quotations have been reduced to 10s. 7½d. per cwt. for ordinary and 10s. 9d. for refined quality.

LONDON, *June* 16.

Tar Products.

Business in tar products continues quiet; and, on the whole, there is no material alteration in the prices. Pitch has weakened slightly for the prompt position, and there are several lots offering at lower figures for delivery this side of September. Ninety per cent. benzol remains firm, and good prices are being paid in all quarters. Solvent naphtha is quiet, and business is difficult to arrange. In this article there appear to be considerable stocks at the moment. There is practically no business doing in crude carbolic. Consumers are unwilling to pay the prices being asked on this side. Creosote is fairly firm in London; but there appears to be more offering in the North and Midlands.

The average values during the week were: Tar, 25s. 6d. to 29s. 6d. Pitch, London, 41s. 6d. to 42s. 6d.; east coast, 41s. 6d. to 42s. 6d.; west coast, Manchester, 40s. 6d. to 41s. 6d.; Liverpool, 41s. 6d. to 42s.; Clyde, 41s. 6d. to 42s. 6d. Benzol, 90 per cent., naked, London, 1s. 0½d. to 1s. 1d.; North, 1s. to 1s. 0½d.; 50-90 per cent., naked, London, 10d. to 10½d.; North, 10d. Toluol, naked, London, 11d. to 11½d.; North, 10¾d. to 11d. Crude naphtha, in bulk, London, 5¼d. to 5⅜d.; North, 4¾d. to 5¼d. Solvent naphtha, naked, London, 11d. to 11½d.; North, 9½d. f.o.b. Heavy naphtha, naked, London, 11½d. to 1s. f.o.b.; North, 10d. to 10½d. f.o.b. Creosote, in bulk, London, 3½d. to 3¾d.; North, 2⅞d. to 3d. Heavy oils, in bulk, 3½d. to 3⅝d. Carbolic acid, casks included, 60 per cent., prompt, east and west coasts, 1s. 3½d. to 1s. 4d. Naphthalene, £5 to £9; salts, 50s. to 55s., bags included. Anthracene, "A" quality, 1½d. to 1¾d. per unit, packages included and delivered.

Sulphate of Ammonia.

The position is practically the same. The efforts on the part of some to try and stop the fall have not been successful; and it is undoubtedly with this idea that the fairly high prices have been paid for the forward position. London is quoted at £12 6s. 3d.; Hull, £12 16s. 3d.; Liverpool, £12 17s. 6d.; Leith, £12 18s. 9d. to £13; Middlesbrough, £12 16s. 3d. to £12 17s. 6d.

COAL TRADE REPORTS.

Northern Coal Trade.

The coal trade is still in some measure hampered by the lack of ready steamers, so that the exports are only moderate. In the steam coal trade, best Northumbrians are from 14s. 10d. to 15s. per ton f.o.b.; second-class steams are near 13s. 6d.; and steam smalls are very plentiful at 7s. 6d. to 10s., according to class. There is a full production of best kinds; and this, with the limited shipment, makes the prices easy. In the gas coal trade the supply is ample; but the great local holidays on the Tyne will reduce it before the end of the month. Best Durham gas coals are quiet at 15s. per ton f.o.b.; second-class are about 13s. 9d. to 14s.; and "Wear specials" are unaltered at 15s. 3d. to 15s. 9d. There are no important contracts reported in the last few days; but sales of cargoes of good gas coals were negotiated for the Mediterranean ports at about 24s. per ton, delivered at Genoa, prompt, with a slightly lower price for forward delivery. The higher range of sea-freights may, however, soon influence the prices of coals at some of the ports just referred to, more especially as stocks of gas coal are believed to be limited there. Coke is easier. Gas coke is scarcer, and is quoted from 17s. 6d. to 18s. 3d. per ton f.o.b. in the Tyne for good quality.

Scotch Coal Trade.

Throughout the Scotch coal trade generally, there is a somewhat lessened demand for all grades, and as a result values have a lower tendency. On Friday, on the Glasgow Coal Exchange, the following were the prices quoted: Steam coal, 13s. to 13s. 6d.; splint, 14s. to 14s. 6d.; ell, 13s. to 13s. 6d.; trebles and doubles, 12s. 9d. to 13s.; and singles, 12s. 3d. to 12s. 9d., f.o.b. Glasgow.

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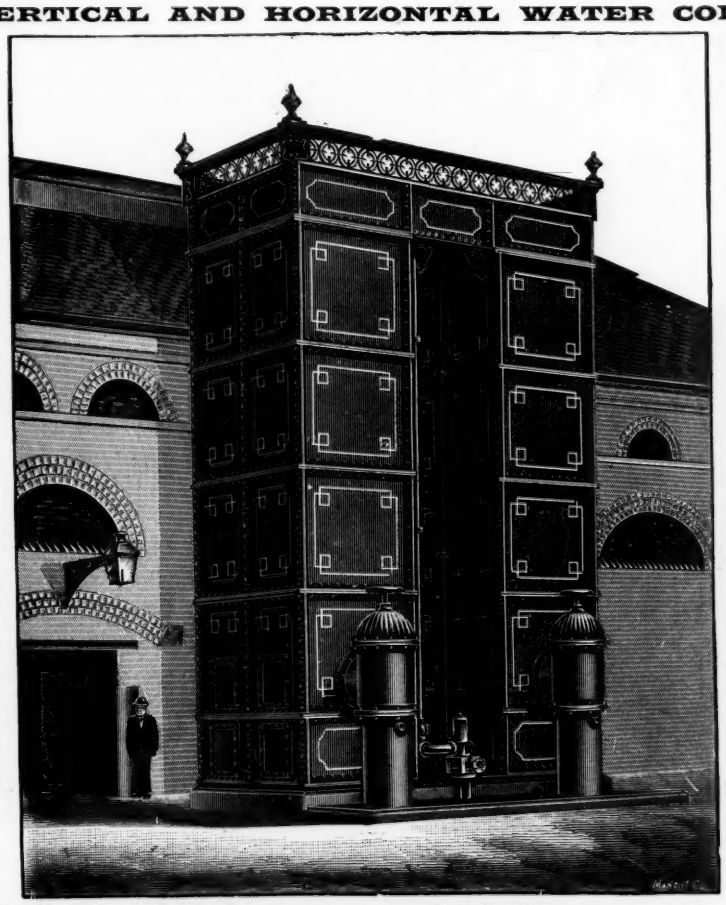

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NORWICH,
EAST HULL,
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BRISTOL,
WALKER AND WALLSEND,
and other Works.

Hammersmith Street Lighting during the National Gas Exhibition.

The Brentford Gas Company applied to the Hammersmith Borough Council for permission to light streets in the neighbourhood of the Uxbridge Road overhead galleries of the White City, in connection with the National Gas Exhibition to be held there next October. They made the liberal offer that no expenditure would devolve upon the Council, that for the period during which the exhibition will run the streets specified would be lighted free of charge, and that the necessary lamps would be erected, and, directly after, removed, without any trouble or cost. The Works Committee, to whom the Company's application was referred, have decided that it is not advisable "to permit the streets in the borough to be used for the purposes indicated:" and they recommended that the Company be informed that the Council are unable to grant their application. The report of the Committee has been approved by the Council; but we understand that the matter will be made the subject of discussion at their ordinary meeting to-morrow.

Ossett Gas Undertaking.—In the report of the Gas Committee of the Ossett Corporation for the past financial year, it is stated that the quantity of gas distributed increased from 121,770,800 to 131,186,000 cubic feet. The gross profit is £7064, and the net profit £1020—a reduction on that of a year ago. The coal strike affected the undertaking to the extent of £400; and there was a falling-off of 245 cubic feet of gas produced from each ton of coal. The report has been adopted by the Town Council.

Gisborne (N.Z.) Gas Company, Limited.—According to the report presented by the Directors of this Company at the last meeting, there was an increase of 12 per cent. in the quantity of gas sold in the year ended the 31st of March. An interim dividend was paid on the 30th of September, amounting to £1857; and the balance (after authorized appropriations) was £5689, out of which the Directors recommended the payment of a further dividend of 1s. 6d. per share, amounting to £1857, and the setting apart of £114 for depreciation, leaving a balance of £3718 to be carried forward.

Water Supply for Killaloe.—Mr. Price, an Engineering Inspector under the Local Government Board for Ireland, recently held an inquiry at Killaloe (co. Clare) relative to the contemplated water supply for that town. The application for a loan had been made by the Scariff District Council; and a memorial in favour of it was read from residents of Killaloe. Mr. Rosenberg said there was an abundant supply of water in the well where the reservoir was to be erected; the average yield per 24 hours being 259,000 gallons. The Council, however, only proposed to provide 10,000 gallons per half day. Dr. Holmes, the Medical Officer of Health, spoke of the necessity of a supply, and attributed outbreaks of typhoid fever in the district to bad water. The water from the source now proposed had been analyzed by Sir Charles Cameron, and described as "a strong and pure water."

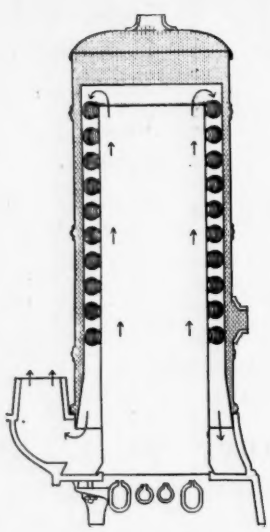
Coventry Water Supply.—A very satisfactory financial result is shown in the report on the year's working of the water undertaking of the Coventry Corporation for the year ended March 31 last; there being an available surplus of £6863. The Water-Works and Fire Brigade Committee have decided to recommend to the City Council that this amount should be dealt with as follows: To devote £5000 in relief of the rates; to set aside £300 as a special reserve against fluctuations in the value of investments; and to carry forward the balance of £1563. The amount proposed to be devoted to the rates is £500 more than was contributed from this source last year.

Lancaster Corporation Water Supply.—The Water Engineer to the Lancaster Corporation (Mr. A. G. Bradshaw) reports that the income from the sale of water in the past financial year was £17,131, compared with £18,601 before; the total receipts being £17,436, against £19,166. The expenditure was £11,993, compared with £12,268. The income is £1730 less than in the previous year (which was an exceptional one with respect to sales by meter); while there is a saving of £275 in expenditure. The net profits for the year are £5442, being £1455 less than before, and £80 more than was estimated in February last. The expenditure on capital account during the year was £4240; making a total with respect to the filtration plant, &c., of £4422.

Colliery Surfacemen and the Gas Workers' Union.—At a recent meeting of the Executive Council of the South Wales Miners' Federation, a discussion arose upon the decision of the conference of the Miners' Federation of Great Britain at Swansea with regard to the question of surface workmen's wages. The General Secretary was instructed to urge upon the Federation the necessity for calling a further conference, in order that national action might be taken. A letter was read from the General Secretary of the Gas Workers' and General Labourers' Union, intimating that their Executive had decided to continue to receive contributions from colliery surface workmen. It was resolved that the officials of the lodges of the Miners' Federation be informed that no further negotiations are contemplated with the gas workers' organization, and that in the July "showcards" all colliery workmen must be members of the Federation. In other words, members of the Gas Workers' Union will be regarded as non-unionists.

Natural Gas in Ontario.—A correspondent of the "Financial News," in a letter which appeared last Thursday, said: "The yield of natural gas in Ontario is rapidly increasing. It is extensively found on the east and north shores of Lake Erie. The gaps between the areas at present productive are steadily being obliterated, and in such a way as to make it not improbable that practically the whole shore will in time be found to be underlaid by gas-bearing strata. It has already been shown, by wells drilled in the land under the water of Lake Erie, that the gas field includes portions of the bed of the lake. The outlines of the field in Kent County, and the large yield of wells on the shore line, strongly suggest that there is an extension of the field, probably one of considerable size, beneath the waters of the lake in that district also. The fact that gas is plentiful has, of course, an influence on its price.

PARKINSON WATER HEATERS



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Claim for a Gas-Saving Appliance.

At the Bow County Court last Friday, before His Honour Judge Smyly, K.C., Messrs. W. Tice and Co. sued Mr. W. G. Short, a publican carrying on business in the Brunswick Road, Poplar, for £5 5s., the price of a gas-saving appliance fitted by them on his premises, or, alternatively, for damages for breach of contract. The defendant was induced to have the appliance because he was told that it would effect a saving of 15 to 20 per cent. on his gas bill, and that if it failed to do this no charge would be made for it. He was also told that, if at any time he was dissatisfied with it, there would be a test. Defendant had complained of the appliance; but the plaintiffs said he would not allow a test to be carried out, though every effort had been made to induce him to do so. As he would not meet his liability, they had been compelled to sue him. Defendant said he was promised a saving of 25 per cent.; but when his Christmas quarter's bill came in it amounted to £11 13s. 4d., against £11 7s. for the corresponding quarter; while for the March quarter it was £10 15s. 10d. compared with £9 18s. 10d. His reason for not allowing the test to be made was because he was disgusted with the whole thing. In the result, his Honour said he thought it had been agreed that there should be a test in the event of a dispute. The only thing left was for the plaintiffs to take the appliance away, and for the defendant to pay them for any damage they might have suffered. He awarded them £2 and costs.

Flueless Geysers.—In a leading article, the "Ironmonger" last Saturday called attention to the letter by Mr. W. M. Mason, the Secretary of the British Commercial Gas Association, on the subject of gas water-heaters, which appeared in the "JOURNAL" for the 10th inst. (p. 727). The writer quotes the portion of the letter referring to the recent fatal accident, and ending with the words: "It is to be hoped that the practice of fixing geysers without flues will be entirely discontinued. Anyone guilty of so doing incurs a very grave responsibility." Our contemporary says: "We cordially endorse the sentiments embodied in the foregoing; and we hope—though it would be too much to say we expect—that the British Commercial Gas Association will succeed in the crusade it has begun."

Labour Disputes at Leeds and Huddersfield.—A strike, which was begun in a small way about a fortnight ago among the workmen under the Highways Department of the Leeds Corporation, and which in its development threatened to paralyze the public services of the city, was settled last Thursday on terms agreeable to the men. The labourers at the gas-works of Meadow Lane and York Street came out on Wednesday; but their places were taken by clerks, whose ready assistance enabled work to be kept going. The new terms give an increase of 2s. a week to some of the men and 1s. a week to others. A dispute arose at the works of Messrs. Read Holliday and Sons, Limited, chemical manufacturers, at Huddersfield. But concessions were granted to the men, and the works were re-started on Thursday, after having been closed for a fortnight.

Gas and Water Profits at Widnes.

At the last monthly meeting of the Widnes Town Council, the Gas and Water Committee reported that, after deducting £1602 for public lighting, the profits on the gas undertaking last year were £3693, and on the water undertaking £1124. Alderman Timmis said the figures were satisfactory, inasmuch as the Committee had to pay heavy sums in connection with the coal strike, and also an increased price for coal. They had, however, sold the residuals at an advanced price. There had been a large increase in the sales of gas; and though they were now working in the light months, they were using as many retorts as they did in the winter five years ago. All things considered, it was the best year they had ever had. Alderman Smith said Widnes still held first place in gas making; and it showed the excellent way in which the undertaking was managed.

Abercarn Gas Undertaking.

In his annual report to the Abercarn District Council, the Gas Engineer and Manager (Mr. J. A. Brentnall) stated that the gross profit on the working of the gas undertaking in the past financial year was £3158, which, notwithstanding an increase of £67 in rates, insurance, and income-tax, and of £71 for the repairs of mains, services, and meters, was £107 more than in the previous year. After paying interest and the instalment of loans, amounting to £2180, also for work done on capital account and paid for out of revenue, amounting to £282, for free installations and new meters, there was a net balance of £695. The revenue for the year, which included public lighting, charged for at 3s. 9d. per 1000 cubic feet, was £7344, compared with £7401 for the year 1911-12. The gas sales showed a decrease of £116, which was chiefly accounted for by the all-round reduction of 3d. per 1000 cubic feet in the price of gas. The gas made in the year was 35,569,100 cubic feet—being a decrease of 4,580,400 cubic feet on the total for the year 1911-12. The quantity accounted for was 28,067,800 cubic feet, against 27,222,400 cubic feet before—an increase of 845,400 cubic feet. The figures for each year showed that 11 per cent. had been taken off the leakage account. At the meeting of the Council last Tuesday, there was some discussion on the subject of the advisability of devoting some portion of the gas profits to the relief of the rates; and it was decided to refer the matter to the Gas Sub-Committee for further consideration. Commenting on Mr. Brentnall's report, the "Monmouthshire Post" last Saturday said: "The most vital part of the report is that which refers to the question of leakage; and the Gas Engineer has done exceedingly well in being able to reduce the leakage by 11 per cent., for which he received the commendation of the members of the Council."

Messrs. James Milne and Son, Limited, have just completed the erection of a 200,000 cubic feet per hour station meter in Toronto.

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Silsden Gas Supply.—The gross profits derived from the gas-works of the Silsden Urban District Council as the result of the past year's working were £1264; while there was an increase to the extent of 1,581,000 cubic feet in the quantity of gas manufactured. The Gas Committee have accepted the tender of Messrs. Clapham Bros. for extensions at the gas-works for £485.

Ilkley Gas-Works Management.—In connection with the gas undertaking of the Ilkley Urban District Council, a report has been issued by a Sub-Committee appointed last November to investigate the means of cheapening the cost of gas production, in consequence of it being found necessary to raise the price 2d. per 1000 cubic feet. A visit has been paid to the gas-works at Oswaldtwistle, and it is recommended that arrangements should be made for the future policy at Ilkley to be based upon them. The inquiry has convinced the Sub-Committee that the Ilkley works can be efficiently carried on with fewer workmen.

Tiverton Gas Undertaking.—The report of the gas undertaking of the Tiverton Corporation for the year ended the 31st of March, which was presented at a meeting of the Town Council on Monday last week, showed that the expenses of manufacture and distribution had been £5928, and the total expenditure £7276. The sale of gas, &c., produced £7762; of coke and other residuals, £2106; and of sulphate of ammonia, £617. The gross profit was £3345, and the net profit £597. The Council's total indebtedness in respect of the gas undertaking is £14,014. The Mayor (Mr. A. T. Gregory) complimented the Lighting Committee and the Gas Manager (Mr. Clark Jeffery) on the efficient conduct of the business.

Increased Storage for the Littlehampton Gas Company.—Not quite three months ago, a commencement was made at Rustington with a new holder for the Littlehampton Gas Company. Its diameter is about 74 feet, and the guide-columns rise to a height of 45 feet. The capacity is 75,000 cubic feet; but this can be doubled if required. The holder will be connected with the gas-works, so that either of the Company's holders will be available for the supply of the entire district should it be necessary to cut off the supply temporarily for repairs. The contract price of the holder, exclusive of the site and the excavations, is £3200; and the work has been carried out by Messrs. Firth Blakeley, Sons, and Co., Limited, of Dewsbury. In view of the early completion of the holder, and in recognition of the satisfactory manner in which the contract has been carried out, the Company's Manager (Mr. A. W. Elton) recently entertained the workmen at a supper, at which the contractors' foreman-in-charge (Mr. Ashmell) and several of the residents in the district were present.

Repair of Gas-Mains along South London Tramway Routes.—At the meeting of the London County Council on the 3rd inst., the Highways Committee reported that the Council decided in May last year that an agreement should be entered into with the Gaslight and Coke Company with regard to the arrangements to be made in connection with the cost of the repair of gas-mains situated under the tracks of the Council's tramways. The South Metropolitan Gas Company were prepared to enter into a similar arrangement with regard to their mains; and the Committee accordingly recommended as follows: "That an agreement be entered into with the South Metropolitan Gas Company providing, as regards works in roads where gas-mains were laid before the construction of the Council's tramways, (1) that the Council shall bear two-fifths of the cost of labour charges incurred by the Company in repairing its mains situated under the tracks; (2) that the Council shall reinstate at its own cost the paving between the outer rails of the tramways; and (3) that the Company shall reinstate at its own cost the paving outside the outer tramway rails." The recommendation was agreed to.

Gas Poisoning in Liverpool.—The Liverpool City Coroner on the 4th inst. held an inquest on the bodies of Sakri Tainio, his daughter, aged two, and his step-daughter, aged eleven, whose deaths occurred in a Liverpool boarding-house on the preceding day. The three were emigrants, and were passing through Liverpool on their way to Minnesota. When they failed to appear at the usual hour, the room in which they had been sleeping was forced. There was a strong smell of gas, and it was found that gas was escaping. Spent matches were found on the floor, and it was thought, from his position, that the man had been trying to get to the door. The Jury returned a verdict that the deaths were due to gas poisoning, and that they were quite accidental. The Coroner suggested that notices in various languages should be placed in these emigrant boarding-houses, explaining what course should be taken in regard to the use of gas and in the event of possible escape. At the meeting of the Liverpool Health Committee next day, reference was made to the suggestion of the Coroner; and the Medical Officer of Health (Dr. Hope) stated that these notices had been in circulation for the last ten or twelve years.

One of the most popular features of the lifeboat procession which took place at Burton-upon-Trent last Saturday was the gas-works dray. Upon it was a monster gas-stove, more than 6 feet high, with side doors left open to enable the spectators to see within a huge sirloin of beef. On the top of the stove were a giant fish-kettle and saucepans—all being under the charge of a diminutive *chef*, who had to climb a step-ladder to get to the top of the stove. As a contrast, there were two ordinary stoves at the end of the dray, and the public were reminded that "Every home should have a gas-stove."

Messrs. Alder and Mackay, of Edinburgh, intimate that, owing to numerous inquiries, they have taken Room No. 1, of the Caxton Hall, Westminster, for the whole of this week, so that those attending the meeting of the Institution may have an opportunity of inspecting the "A. & M." controller performing its work in the various phases for which it is adapted. Among recent installations of the "A. & M." system of pressure-wave automatic lighting is one at Ballymena, where the Town Council have decided upon installing sixty of Alder and Mackay's hurricane proof lanterns fitted complete with their lighting and extinguishing apparatus, to be in readiness for next lighting season. The Bridge of Allan (N.B.) Town Council have decided to extend the "A. & M." system of pressure-wave automatic lighting upon the public lamps, after experimenting with them during the past winter.

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This unique Combination has been specially designed for Flats, Bungalows, Tenements, and Houses in which space is an important consideration.

It is compact and comprehensive, and economises space, piping, and labour in fitting.

COMPRISES:—

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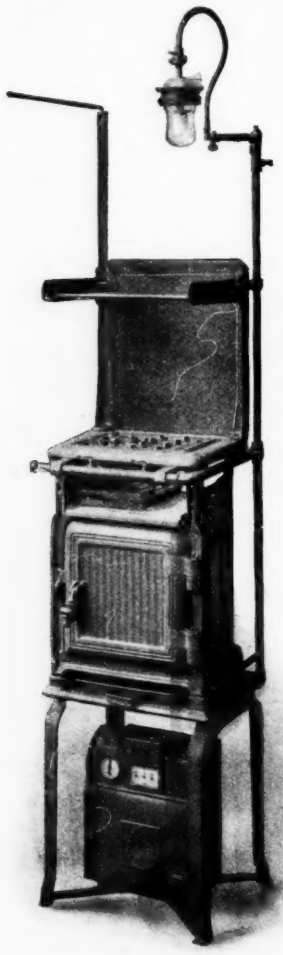

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SHOW-ROOMS AND BRANCHES: 25, Princes St., Oxford Circus, W. 136, Renfield St., GLASGOW; 56, Broad St., BIRMINGHAM; 83, Old Market St., BRISTOL; 13, Whitworth St. West, MANCHESTER 8, Exchange Place, Donegall St, BELFAST; 333, Queen St., MELBOURNE; and 12, Cunningham Lane, Pitt St., SYDNEY, N.S.W.

The Wootton and District Gas Company, Limited, has been registered with a capital of £2500, in £1 shares, to take over the business of a gas company carried on by F. Hawkyard, at Haven Street, Isle of Wight.

Messrs. R. & A. Main, Limited, have just completed the installation of the kitchens at the new Waterloo Station refreshment-rooms, for the London and South-Western Railway Company. It includes large gas baking and roasting ovens, grillers, &c.

The Gas Examiner for the borough of Wimbledon (Mr. J. H. Johnston) has been instructed to make each year not less than sixteen tests for calorific power and four tests for illuminating power, pressure, and purity of the gas supplied in the borough by the Wandsworth, Wimbledon, and Epsom District Gas Company. He is to be paid a fee of 25 guineas for the tests and for reporting thereon.

Serious inconvenience was recently caused to the tradespeople and private residents at Redhill by a failure of the electric light on a Saturday evening. The mishap afforded the Redhill Gas Company an opportunity of bringing under the special notice of those who had been inconvenienced, and of the residents generally, the fact that gas is not only reliable, but economical in use, and that recent events prove the wisdom of adopting it for lighting purposes. This is set forth boldly in an advertisement in a local paper.

A copy of the Industrial Supplement to the "Western Mail" for last Wednesday, which has just reached us, contains evidence that the Cardiff Gas Company are continuing to keep the advantages of gas well before the public. The General Manager and Secretary of the Company (Mr. George Clarry) has in it a striking page advertisement, 17 in. by 11 in., in which gas is characterized as "the universal provider of light, heat, and power," and, supplied at the Company's charges, is "unexcelled for cheapness and reliability."

The Local Government Board have informed the Wombwell Urban District Council that, in view of the Wombwell Local Board Gas Act, 1879, they are not in a position to give their consent to a proposed appropriation of £750 from the profits of the gas undertaking for the formation of a reserve fund.

Among the new joint-stock companies recently registered are the Carboil Syndicate, Limited, Financiers, with a capital of £525, in 1s. shares; the Del Monte Process Syndicate, Limited, £500 capital, in 1s. shares; Lowen Hartridge and Co., Limited, dealers in gas-burners, £5000 capital, in £1 shares; and Pioneer Pump Patents (1913), Limited, £10,000 capital, in £1 shares.

With reference to the article in last week's issue on the Inauguration of the new gasholder at Oldham, we learn that the shade of grey in which this holder was painted, and which occasioned so many flattering remarks from the visitors present, was the manufacture of Messrs. John E. Williams and Co., of Manchester, and known as their "Viternus Steel Composition" paint.

We have received from the Chicago Pneumatic Tool Company's Compressor Department their Bulletin "No. 34 L," which has just been issued. This pamphlet is one of the series covering the Company's complete compressor business, and deals particularly with general engineering information of value to users of compressed air. It contains tables giving efficiencies of air compression at different altitudes, density of gases and vapours, mean effective pressures and horse powers, loss of pressure due to friction in pipes, and many others. It also furnishes the data required for intelligent estimates. Views of various types of compressors are given, as well as illustrations showing the interior of the Company's compressor plant at Franklin (Pa.). The pamphlet can be had from the Chicago Pneumatic Tool Company, No. 9, Bridge Street, Westminster, S.W.

GAS COMPANIES' STOCK AND SHARE LIST.

The Stock Exchange has passed through an anxious week, and has emerged from it with intense relief. At the start, the mid-June settlement was overhanging it like a dark cloud, and no man wist what the outcome of it might be. Forebodings were naturally gloomy for reasons which were pretty well notorious, and need only briefly be summarized as enforced wholesale realizations, almost inevitable catastrophes to some operators, and an imminent outbreak of war between the Balkan Powers. Happily, the worst has been averted—thanks to the resolute action of the Tsar in the one case, and, in the other, to successful arrangements to relieve the pressure being effected, whereby the failures (thus far) have been limited to three of minor importance. But it goes without saying that in the conflict prices have suffered. The opening day was despondent and all markets flat, with tighter money and liquidation in full swing. Consols fell ⅜, Rails were lower all round, and American very weak. Tuesday was a day of depression; and things might have been worse but for "bears" buying back and a few of the public rising at cheap prices. Consols were the steadiest market. Wednesday opened in serious mood; markets holding their breath as they awaited signs how the settlement might shape. At length, gathering encouragement, they proceeded to amend, and moderate and cautious dealings closed at an advance. Consols recovered ¼, and the rest in general were firmer. Thursday was a little shy, and showed weakness, but cheered up on receipt of foreign advices. Most markets were stronger, except Government issues, where Consols went back ¼. On Friday, two small failures were reported; but markets were comparatively cheerful at things being no worse. Prices in rails were fortified by some amount of buying; and Americans were stronger. Consols were unchanged. Saturday was quiet and peaceful—feeling tolerably sure that difficulties were practically surmounted, though there might yet be a hitch here or there. Consols were quite firm at 73⅛ to 73⅜—a fall of ¼ in the week. In the Money Market, the tendency at first was very stiff; but the tension afterwards relaxed, and the close was easy. Business in the Gas Market was only on a moderate scale, scarcely up to a fair average. Prices in gas undertakings usually take a line of their own (a firm one), scarcely moved by the factors which ordinarily affect other markets. But it would be too much to expect that in the hurly-burly of last week anything saleable on the Stock Exchange should escape wholly unscathed. And so prices have fallen, but moderately only. In Gaslight and Coke issues, the ordinary was fairly active, and, after touching 102, dropped momentarily to 99½ and recovered later; the quotation closing only 1 lower. In the secured issues, the maximum marked 77 (a fall of 2), the preference 93¾ to 95⅜, and the debenture 73 *ex div.* South Metropolitan changed hands at 108 to 109½—a fall of ½. In Commercials, the 4 per cent. made 106. Among the Suburban and Provincial group, Alliance and Dublin was done at 73, Brighton original at 210, and (on the local Exchange) Sheffield "A" at 226½. In the Continental companies, Imperial fell 2, with business at 160 to 164, Union preference changed hands at 126½ to 127⅜ *ex div.*, and European at 17⅛ to 17⅞. Among the undertakings of the remoter world, Buenos Ayres realized 92 and 92½, Primitiva 5⅝ to 6 1/16, ditto preference 4 15/16 to 5, and ditto debenture 94⅜ to 94½.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
1,551,868	Stk.	April 11	5	Alliance & Dublin Ord.	70—73	..	6 17 0
374,000	,,	Jan. 16	4	Do. 4 p.c. Deb.	84—87	..	4 12 0
280,000	5	April 11	7½	Bombay, Ltd.	6½—6⅞	..	5 11 1
50,000	10	Feb. 27	15	Bournemouth Gas & Water Ord. 10 p.c.	28¾—29½	..	5 1 8
332,000	10	,,	7	Do. B 7 p.c.	15½—16	−¼	4 7 6
75,000	10	,,	6	Do. Pref. 6 p.c.	13⅞—14½	..	4 4 3
880,000	Stk.	Feb. 27	14	Brentford Consolidated	260—265	..	5 5 8
330,000	,,	,,	11	Do. New	200—205	..	5 7 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	113—115	..	4 6 11
206,250	,,	June 13	4	Do. 4 p.c. Deb.	92—94*	..	4 5 1
217,380	Stk.	Feb. 27	11	Brighton & Hove Orig.	206—211	..	5 4 3
244,200	,,	,,	8	Do. A Ord. Stk.	151—154	..	5 3 11
530,000	20	Mar. 28	12½	British	45—46	..	5 8 8
120,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb. Stk.	89—91	..	4 7 11
245,771	Stk.	,,	4	Buenos Ayres 4 p.c. Deb.	91½—93½	..	4 5 7
100,000	10	—	—	Cape Town & Dis., Ltd.	2—3	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	4—5	..	—
100,000	Stk.	Dec. 30	4½	Do. 4½ p.c. Deb. Stk.	78—83	..	5 8 5
157,150	Stk.	Feb. 13	5	Chester 5 p.c. Ord.	109½—111½	..	4 9 8
1,513,280	Stk.	Feb. 27	5/9/4	Commercial 4 p.c. Stk.	105—107	..	5 2 1
660,000	,,	,,	5½	Do. 3½ p.c. do.	102—104	..	5 2 6
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	69—71*	−½	4 4 6
800,000	Stk.	,,	4	Continental Union, Ltd.	80—83*	−2	4 16 5
200,000	,,	,,	7	Do. 7 p.c. Pref.	126—129*	..	5 8 6
492,270	Stk.	—	5½	Derby Con. Stk.	124—125	..	4 12 0
55,000	,,	—	4	Do. Deb. Stk.	103—105	..	3 16 2
1,002,180	10	Jan. 16	10	European, Ltd.	17⅛—18½	..	5 8 1
16,415,840	Stk.	Feb. 13	4/17/4	Gaslight 4 p.c. Ord.	100—102	−1	4 15 6
2,600,000	,,	,,	3½	Do. 3½ p.c. max.	77—80	−2	4 7 6
4,062,235	,,	,,	4	and 4 p.c. Con. Pref.	94—97	..	4 2 6
4,674,850	,,	June 13	3	Coke 3 p.c. Con. Deb.	71½—73½*	..	4 1 8
258,740	Stk.	Mar. 13	5	Hastings & St. L. 3½ p.c.	83—91	..	5 9 11
89,500	,,	,,	6½	Do. do. 5 p.c.	—	..	—
70,000	10	April 25	11	Hongkong & China, Ltd.	17—17½	..	6 5 9
131,000	Stk.	Mar. 13	7⅜	Ilford A and C	152—155	..	4 18 4
65,780	,,	,,	6⅜	Do. B	120—122	..	5 0 5
66,500	,,	Dec. 30	4	Do. 4 p.c. Deb.	89—91	..	4 7 11
4,940,000	Stk.	May 16	9	Imperial Continental	160—165	−2	5 9 1
1,336,000	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	85—87	..	4 0 6
300,942	Stk.	Mar. 13	6	Lea Bridge Ord. 5 p.c.	120—123	..	4 17 7
561,000	Stk.	Feb. 27	10	Liverpool United A	208½—210½	..	4 15 0
718,100	,,	,,	7	Do. B	151—153	..	4 11 6
306,083	,,	Dec. 30	4	Do. Deb. Stk.	98—100	..	4 0 0
63,480	Stk.	Jan. 16	3	Maidstone 3 p.c. Deb.	68—70	..	4 5 9
75,000	5	June 13	6	Malta & Mediterranean	4⅜—4⅝*	..	6 3 1
250,000	100	April 1	4½	Met. of Melbourne 4½ p.c. Deb.	98—100	..	4 10 0
541,920	20	May 30	4	Monte Video, Ltd.	12⅝—13	..	6 3 1
1,775,892	Stk.	Feb. 27	4½	Newc'tle&G'tesh'd Con.	98—99	..	4 10 11
529,705	Stk.	Dec. 30	3½	Do. 3½ p.c. Deb.	85—86	..	4 1 5
55,940	10	Feb. 27	7/7/0	North Middlesex 7 p.c.	13—14	..	5 4 7
300,000	Stk.	May 16	8	Oriental, Ltd.	124—129	..	6 4 0
60,000	5	Mar. 28	10	Ottoman, Ltd.	8—8½	..	5 17 8
60,000	50	Feb. 27	13	Portsea, Island B	125—128	..	5 1 7
100,000	50	,,	12	Do. C	122—125	..	4 16 0
249,980	5	May 16	8	Primitiva Ord.	5⅝—6¼	..	6 8 0
499,960	5	Dec. 30	5	,, 5 p.c. Pref.	4⅞—5	−1/16	5 0 0
521,600	100	June 2	4	,, 4 p.c. Deb.	93—95	..	4 4 3
346,198	Stk.	Dec. 30	4	River Plate 4 p.c. Deb.	92—94	..	4 5 1
275,000	5	Apl. 11	12	San Paulo, Ltd.	—	..	—
150,000	10	,,	6	Do. 6 p.c. Pref.	11¼—11⅞	..	5 2 2
125,000	50	Jan. 2	5	Do. 5 p.c. Deb.	49—51	..	4 18 0
135,000	Stk.	Mar. 13	10	Sheffield A	225—227	..	4 8 1
209,984	,,	,,	10	Do. B	225—227	..	4 8 1
523,500	,,	,,	10	Do. C	225—227	..	4 8 1
90,000	10	May 30	7½	South African	9½—10½	..	7 2 10
6,429,895	Stk.	Feb. 13	5/9/4	South Met., 4 p.c. Ord.	108—110	−½	4 19 4
1,895,445	,,	Jan. 16	3	Do. 3 p.c. Deb.	73—75	..	4 0 0
209,820	Stk.	Feb. 27	8½	South Shields Con. Stk.	161—163	..	5 4 4
952,795	Stk.	Feb. 27	6	S'th Suburb'n Ord. 5 p.c.	117—119	..	5 0 10
60,000	,,	,,	5	Do. 5 p.c. Pref.	115—117	..	4 5 6
117,058	,,	Dec. 30	5	Do. 5 p.c. Deb. Stk.	117—119	..	4 4 0
594,740	Stk.	May 16	5	Southampton Ord.	100—103	..	4 17 1
120,000	Stk.	Feb. 13	7⅛	Tottenham A 5 p.c. and B 3½ p.c.	139—142	..	5 2 1
483,940	,,	,,	5⅝		115—117	..	4 18 3
149,470	,,	Dec. 30	4	Edmonton 4 p.c. Deb.	92—94	..	4 5 1
182,380	10	,,	5	Tuscan, Ltd.	5—6	..	8 6 8
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	96½—98½	..	5 1 6
236,476	Stk.	Feb. 27	5	Tynemouth, 5 p.c. max.	114—115	..	4 6 11
255,636	Stk.	Mar. 13	6⅞	Wands- B 3½ p.c.	137—140	..	4 18 2
88,416	,,	Dec. 30	3	worth 3 p.c. Deb. Stk.	68—70	..	4 5 9

Prices marked * are "Ex-Div."

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

GAS AND WATER ENGINEER. Mansfield Corporation. Applications by June 24.
CHIEF DISTRICT INSPECTOR. Glasgow Gas Department. Applications by June 30.
GAS MANAGER. Newry Urban District Council. Applications by June 26.
RETORT-HOUSE FOREMAN. North Middlesex Gas Company.
FOREMAN (FITTINGS DEPARTMENT). Applications by June 23 to No. 5750.
WORKING FOREMAN. No. 5753.

Appointments, &c., Wanted.

CHEMICAL PLUMBER. Davies, Galloway Road, Shepherd's Bush, W.

Agency Wanted. No. 5749.

Plant, &c. (Second Hand), for Sale.

PRESSURE RECORDERS. No. 5752.

Loan Wanted by Gas Company. No. 5751.

Sales of Stocks and Shares.

BRENTFORD GAS COMPANY. London Mart. June 24.
BRIGHTON GAS COMPANY. London Mart. June 24.

Sales of Stocks and Shares.—*continued.*

BRITISH GASLIGHT COMPANY. London Mart. June 24.
DANISH GAS COMPANY. London Mart. July 8.
EUROPEAN GAS COMPANY. London Mart. June 24.
GASLIGHT AND COKE COMPANY. London Mart. July 8.
HERNE BAY GAS COMPANY. By Tender. June 26.
HOUGHTON-LE-SPRING GAS COMPANY. London Mart, July 8.
ILFORD GAS COMPANY. London Mart. June 24.
NORTH MIDDLESEX GAS CO. London Mart. June 24.
SOUTH AFRICAN LIGHTING ASSOCIATION. London Mart. June 24.
SOUTH SUBURBAN GAS CO. London Mart. June 24.
SOUTHEND WATER COMPANY. London Mart. July 8.
SOUTHGATE GAS COMPANY. London Mart. July 8.
TOTTENHAM GAS COMPANY. London Mart. June 24.

TENDERS FOR

Coal.

CONNAH'S QUAY GAS AND WATER COMPANY. Tenders by June 25.
DAWLISH GAS COMPANY. Tenders by June 30.
EAST RETFORD GAS DEPARTMENT. Tenders by July 5.
GOOLE URBAN DISTRICT COUNCIL. Tenders by June 30.
HAWORTH URBAN DISTRICT COUNCIL. Tenders by June 24.

Coal.—*continued.*

ILKESTON GAS DEPARTMENT. Tenders by June 27.
OSSETT GAS DEPARTMENT. Tenders by June 30.
PAIGNTON GAS COMPANY. Tenders by July 10.
TEIGNMOUTH URBAN DISTRICT COUNCIL. Tenders by June 30.
TENBY GAS COMPANY. Tenders by June 27.

Gasholders (Dismantling and Removing).

HUDDERSFIELD GAS DEPARTMENT. Tenders by July 5.

Meter (Station) Resheeting.

SALFORD GAS DEPARTMENT. Tenders by June 26.

Retort-House and Coals-Stores.

SHEFFIELD GAS COMPANY. Tenders by July 8.

Sulphuric Acid.

EAST HULL GAS COMPANY. Tenders by June 25.

Tar and Liquor.

ACCRINGTON GAS AND WATER BOARD. Tenders by June 27.
GOOLE URBAN DISTRICT COUNCIL. Tenders by June 30.
SEAFORD GAS COMPANY.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

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Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

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